AD-A041 387 CORPS OF ENGINEERS CINCINNATI OHIO F/G 8/6
DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. MAIN REPORT. PART--ETC(U)
NOV 69

UNCLASSIFIED NL

1 OF 7
AD
A041387

ADA041387

0155

Development of WATER RESOURCES in APPALACHIA

STATEMENT A
...ed for public release;
Distribution ...limited

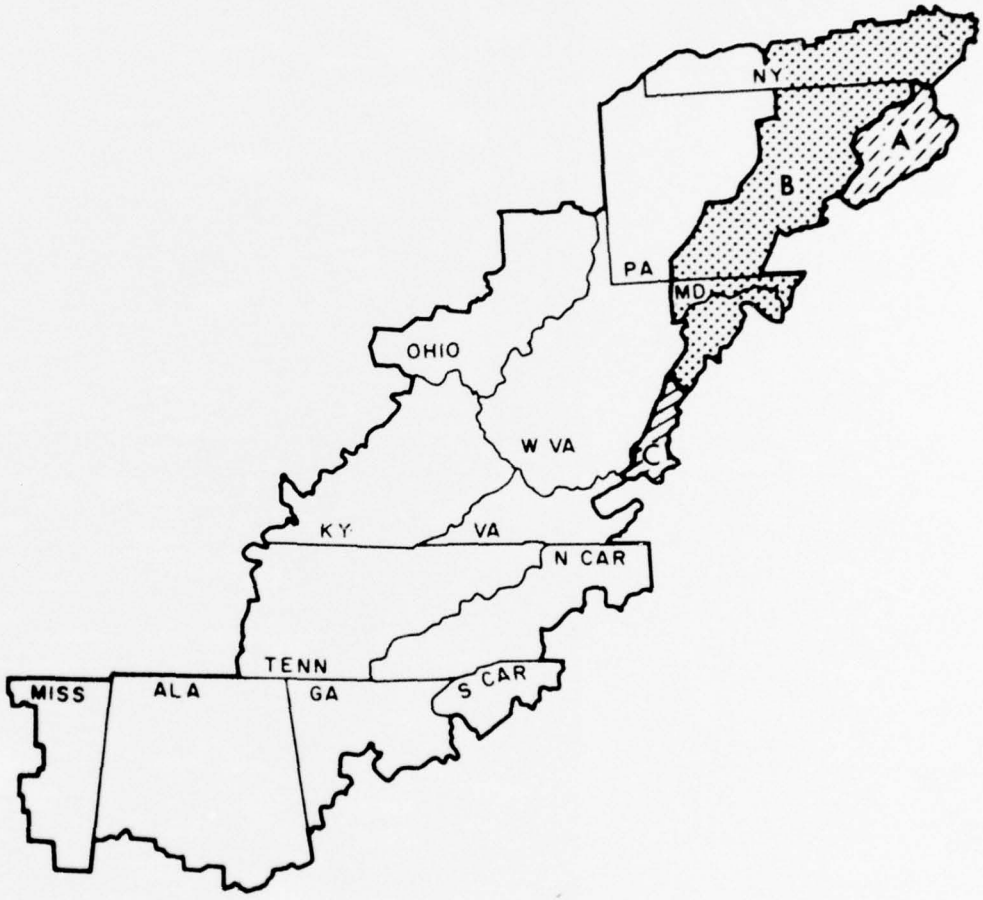
MAIN REPORT
PART II
SUB-REGIONAL PLANS
CHAPTERS 1 thru 6

ORIGINAL CONTAINS COLOR PLATES; ALL DTIC
REPRODUCTIONS WILL BE IN BLACK ...

...C
...
JUL 11 197...
...
A

WATER SUB-REGIONS
A, B, C
covering portions of
MD., N.Y., PA., VA.
and W.VA.

OFFICE OF APPALACHIAN STUDIES


NY
A
B
PA
MD
OHIO
W VA
C
KY
VA
N CAR
TENN
MISS
ALA
GA
S CAR

DEPARTMENT OF THE ARMY
OFFICE OF APPALACHIAN STUDIES, CORPS OF ENGINEERS
P. O. BOX 1159
CINCINNATI, OHIO 45201

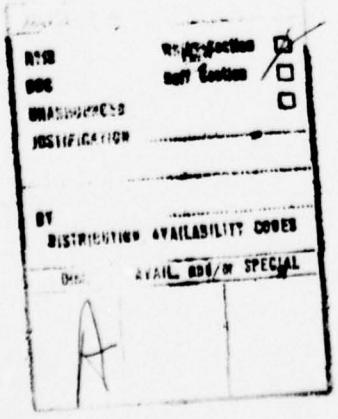
IN REPLY REFER TO

TO: THE READER

This volume ~~(Number 3)~~ is one of three that comprise Part II, "Sub-Regional Plans," to the Main Report for Development of Water Resources in Appalachia. The volume contains the first six chapters of the 20 chapters that make up Part II. Chapters 1 and 2 present information on Sub-Region "A" in eastern Pennsylvania; Chapters 3 and 4 cover Sub-Region "B", which embraces central Pennsylvania and small portions of New York, Maryland and West Virginia. Chapters 5 and 6, Sub-Region "C", cover a five-county area in northwestern Virginia.

The first chapter of each pair presents physical and economic conditions in the sub-region today as well as estimates of the potential for future development and the role water may play. The second chapter contains a definition of the water related needs and the evolution of a water resources plan of development to meet those needs. The plan presented generally contains both structural and non-structural elements as well as future studies that will be required after anticipated growth trends begin to be realized.

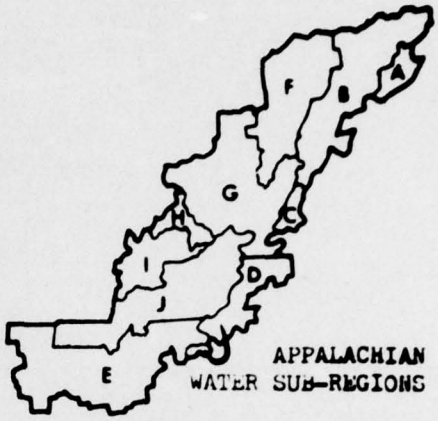
The Summary Report (Part I, Volume 1) should be consulted for recommendations made concerning specific elements in the water resources plan presented in the even numbered chapters in this volume. A volume index for the Main Report and its nine supporting Appendices is included on the next two pages for your convenience.



JOHN C. H. LEE, JR.
Colonel, Corps of Engineers
Director

410111

REPORT
For
DEVELOPMENT OF WATER RESOURCES IN APPALACHIA



APPALACHIAN WATER SUB-REGIONS

VOLUME INDEX

MAIN REPORT

Volume Number	Part Number	Chapter Number	Contents
1	I	-	Summary Report
2	I	-	Key Map Folio (By States)
3	II	1	Water Sub-Region A Today
		2	Shaping the Plan for Sub-Region A
		3	Water Sub-Region B Today
		4	Shaping the Plan for Sub-Region B
		5	Water Sub-Region C Today
		6	Shaping the Plan for Sub-Region C
4	II	7	Water Sub-Region D Today
		8	Shaping the Plan for Sub Region D
		9	Water Sub-Region E Today
		10	Shaping the Plan for Sub-Region E
		11	Water Sub-Region F Today
		12	Shaping the Plan for Sub-Region F
5	II	13	Water Sub-Region G Today
		14	Shaping the Plan for Sub-Region G
		15	Water Sub-Region H Today
		16	Shaping the Plan for Sub-Region H
		17	Water Sub-Region I Today
		18	Shaping the Plan for Sub-Region I
		19	Water Sub-Region J Today
		20	Shaping the Plan for Sub-Region J
6	III	1	Introduction to Project Analyses
		2	Tamaqua Local Protection Project
		3	Royal Glen Reservoir
		4	Hipes Reservoir
7	III	5	Clinchfield Reservoir
		6	Roaring River Reservoir
		7	Curry Creek Reservoir
8	III	8	Dalton Reservoir
		9	Coosa River Navigation
		10	Stannard Reservoir
9	III	11	St. Petersburg Reservoir
		12	Greenbrier Reservoirs
		13	Lower Knox Reservoir

REPORT
For
DEVELOPMENT FOR WATER
RESOURCES IN APPALACHIA

VOLUME INDEX

MAIN REPORT (cont'd)

Volume Number	Part Number	Chapter Number	Contents
10	III	14	Whiteoak Reservoir
		15	Logan Reservoir
		16	Midland Local Protection Project
11	III	17	Upper French Broad System (TVA)
		18	Yellow Creek Port (TVA)
		19	Otocsin (Pa.)
		20	Naturealm (Pa.)
12	IV	-	Concepts & Methods
13	V	-	State Water Supplements: Ala., Ga., Ky., Md., Miss., N.Y., N.Car.
14	V	-	State Water Supplements: O., Pa., S.Car., Tenn., Va., W.Va.
15	VI	-	History, Coordination & Cooperation

APPENDICES

Volume Number	Appendix Designation	Title
16	A	Agriculture, Forestry and Conservation
17	B	Power Supply and Requirements
18	C	The Incidence and Formation of Mine Drainage Pollution
19	D	Water Supply and Water Pollution Control
20	E	Economic Base Study
21	F	Recreation and Aesthetics
22	G	Fish and Wildlife Resources
23	H	Ground Water
24	I	Mineral Industry Resources and Water Requirements

25 Loose Leaf Volume-Errata and Addenda

PREFACE

RELATION OF PART II (VOLUMES 3, 4 and 5) TO OTHER REPORT COMPONENTS

The principal planning and economic aspects of this study are found in the first four parts of the Main Report and throughout a number of appendices. Part I, "Summary Report," presents the overall development plan of the Appalachian Region as a whole and outlines the specific courses of action required to attain it. Part II (this Part) provides a detailed analysis, in two chapters per water sub-region, of the facts and their weighting that led to development of the plan.

Part III, "Project Analyses," presents detailed information on each recommended project concerning hydrologic, hydraulic, structural characteristics and costs as well as benefits, cost allocations and apportionment.

Specific methodology for measuring the impact of public water resource investments is contained in Part IV, "Planning Concepts and Methods." In Part IV some of the methods and techniques used in plan development are discussed in terms of the research undertaken by the Office of Appalachian Studies to assist in better analysis of the effects of public investment in water resources.

In summary, Part II furnishes the basic economic and physical data used in the planning process and tells how they are combined to arrive at the basis for planning decisions. In this Part the physical characteristics (in terms of engineering concepts) and the economic conditions of the sub-regions are reviewed and estimates made of the potentials for development and the role water may hold. This process leads to a statement of the needs which spring from development of the regional potential, and which the sub-regional plan may fulfill.

SOURCES OF DATA

Sources of data are mentioned throughout the report but it is appropriate to mention several principal sources here. The state development plans in many instances proved the best source of data on current state economic objectives for each region and sub-region. The Appalachian Regional Commission has summarized these plans. Their summary, State and Regional Development Plans in Appalachia, 1968 (December 1967), serves as a guide to the State reports but is not a substitute for them. The Appalachian Data Book, June 1967, also by the Appalachian Regional Commission, is a convenient source for basic economic and social data organized for the 63 State Planning Sub-Regions. The Appalachian Industry Location Studies Program, which was undertaken by Fantus Area

Research for the Appalachian Regional Commission, has furnished much information on twenty-five industries expected to have a significant potential for growth in the region and for which often multiple location opportunities are present. The Preliminary Analysis for Economic Development Plan produced by Litton Industries for the Commission also was used as a source material.

The planning process, as carried out by the action offices, produced the physical data and a wealth of economic data which, together with the field surveys undertaken directly by the Office of Appalachian Studies, became a basic source for this Part.

(6)

(1)

REPORT FOR DEVELOPMENT

OF

WATER RESOURCES IN APPALACHIA.

Main Report.

Part II, Volume 3.

PART II - SUB-REGIONAL PLANS. Chapters 1 thru 6.

VOLUME 3

(11) Nov 69

(12) 527 p.

CHAPTERS:

1 and 2 - SUB-REGION "A" - PENNSYLVANIA

3 and 4 - SUB-REGION "B" - NEW YORK, PENNSYLVANIA
MARYLAND AND WEST VIRGINIA

5 and 6 - SUB-REGION "C" - VIRGINIA

DDC
RETURN
NOV 21 1977
A

ORIGINAL CONTAINS COLOR PLATES: ALL DDC
REPRODUCTIONS WILL BE IN BLACK AND WHITE

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

Office of Appalachian Studies

Corps of Engineers

November 1969

410111

1/5

DEVELOPMENT
OF
WATER RESOURCES
IN
APPALACHIA

MAIN REPORT
PART II
SHAPING A PLAN

CHAPTER 1 - WATER SUB-REGION A

TABLE OF CONTENTS

Par.	Subject	Page II-1-
	SECTION I - THE REGION TODAY	
1	POLITICAL	1
2	PHYSICAL	2
	Physiography and Geology	2
	Anthracite Mining	7
	Climate	8
	Runoff	10
	Delaware River Basin	12
	Susquehanna River Basin	12
	Transportation Networks	13
3	RESOURCES DEVELOPMENT	14
	Human Resources	14
	Minerals	25
	Lands and Environmental Aspects	25
	Lands	25
	Land Disturbance	28
	Environmental Aspects	29
	Water Resources Development - Federal	29
	Corps of Engineers	29
	Reservoir Projects	29
	Local Protection Projects	33
	Studies Underway	33

CHAPTER 1 - WATER SUB-REGION A

TABLE OF CONTENTS
(cont'd)

Par.	Subject	Page II-1-
	U. S. Department of Agriculture	39
	Water Resources Development - Non-Federal	39
	Pennsylvania Power and Light Company	39
	State and Local Protection Projects and Reservoirs	39
	Commonwealth of Pennsylvania Mine Drainage Abatement Program	41
	Municipal	41
	SECTION II - SOCIO-ECONOMIC STRUCTURE	
4	INTRODUCTION	45
	Planning Devices	45
	Economic Characteristics	46
	Capital Availability	53
	Local Attitudes	54
5	GROWTH AREAS	63
	Scranton-Wilkes-Barre-Hazelton	66
	Pottsville	71
	Poconos Growth Area	75

CHAPTER 1 - WATER SUB-REGION A

LIST OF TABLES

Table No.	Title	Page II-1-
1-1	Storm Precipitation Data for Selected Locations, Water Sub-region A	9
1-2	Stream Gaging Data at Key Stations in Water Sub-region A	11
1-3	Pertinent Data, Major Reservoirs	34
1-4	Pertinent Data, Federal Local Protection Projects	37
1-4a	Pertinent Data, State Local Protection Projects and Reservoirs	38
1-5	Pertinent Data, Upstream Watershed Projects	40
1-6	Municipal Water Facilities	41
1-7	Summary of Water Supplied by Utilities Companies: 1964	44
1-8	Employment by Sector For 1950 and 1960	64
1-9	Socio-Economic Characteristics	65
1-10	Projected Increase and Levels of Employment In Lackawanna & Luzerne Counties	70

LIST OF FIGURES

Figure No.	Title	Page II-1-
1-1	Location Map	3
1-2	Physical Features	5
1-3	Anthracite Deposits in Water Sub-region A	8
1-4	Precipitation Data for Selected Stations	10
1-5	Highways and Airports	15
1-6	Railroads	17
1-7	Distribution of Urban, Rural Non-Farm and Farm Population	14

LIST OF TABLES
(cont'd)

Figure No.	Title	Page II-1-
1-8	Population Centers and Percent of Urbanization	19
1-9	1960 Population Distribution by Age & Sex	21
1-10	Population Distribution by Educational Attainment	22
1-11	Higher Education Facilities	23
1-12	Land Use in Sub-region A	26
1-13	Distribution of Agricultural Land by Land Capability Class	27
1-14	Scenic Sites	31
1-15	Water Resources Development	35
1-16	Planning Areas	47
1-17	Value of Farm Products	51
1-18	Unemployment	55
1-19	Distribution of Family Income	57
1-20	Sources of Income	58
1-21	Urban Planning Expenditures	59
1-22	Financial Situations	61
1-23	Population and Employment - SMSAs	67
1-24	Civilian Labor Force Trends - Luzerne and Lackawanna Counties	68
1-25	Population and Employment in Schuylkill County Compared to Water Sub-region A	72
1-26	Population and Employment in Poconos Counties Compared to Monroe County and Water Sub-region A	76

CHAPTER 1 - WATER SUB-REGION A

SECTION I - THE REGION TODAY

1. POLITICAL

Water Sub-region A comprises a seven-county area in northeastern Pennsylvania: Carbon, Lackawanna, Luzerne, Monroe, Pike, Schuylkill and Wayne (see Figure 1-1). The largest cities in the area include Scranton, Wilkes-Barre, Hazleton and Pottsville.

All seven counties are located in Economic Sub-region 3, delimited by the Office of Business Economics (OBE), U.S. Department of Commerce. OBE Economic Sub-region 3 is centered on the Wilkes-Barre and Scranton Standard Metropolitan Statistical Areas (SMSAs). Water Sub-region A is coincident with State Planning Sub-region 10, which is, in turn, coterminous with the Northeastern Pennsylvania Development District.

Cities lying within and adjacent to the Water Sub-region include: (a) Scranton, Wilkes-Barre, Hazleton and Pottsville within the Water Sub-region, and (b) Philadelphia, Reading and Allentown, outside of the Water Sub-region.

The Water Sub-region is within the boundaries of two Army Engineer Districts: (a) the Susquehanna River Basin is within the jurisdiction of the Baltimore District, and (b) the Philadelphia District is responsible for the Delaware River Basin. A Delaware River Basin Commission has been formed, and a Susquehanna River Basin Commission is being organized.

The seven counties in the Water Sub-region are included in the North Atlantic Regional Water Resources Study (NARS) and in the Northeastern United States Water Supply Study (NEWS). There are seven Soil Conservation Districts; one in each county.

The Tocks Island Regional Advisory Council (TIRAC) is a quasi-political group. It functions as a liaison between residents of the Tocks Island development area and planners of: (a) the federal project for construction of the Tocks Island multiple purpose reservoir, and (b) development of the Delaware Water Gap National Recreation Area.

2. PHYSICAL

Physiography and Geology

Water Sub-region A has a land area of 4,427 square miles. Physical features of the area are shown on Figure 1-2. The Water Sub-region lies entirely within the Appalachia Highlands, which covers most of the northeastern United States. Most of the area has been subject to the effects of glaciation.

Wayne, Pike, Monroe, Carbon and the eastern half of Schuylkill Counties are in the Delaware River Basin. They are drained by the Lackawaxen, Lehigh, Little Schuylkill and Schuylkill Rivers. The remainder of the Water Sub-region to the west lies in the Susquehanna River Basin. Most of this area's drainage is provided by the Lackawanna and North Branch of the Susquehanna Rivers.

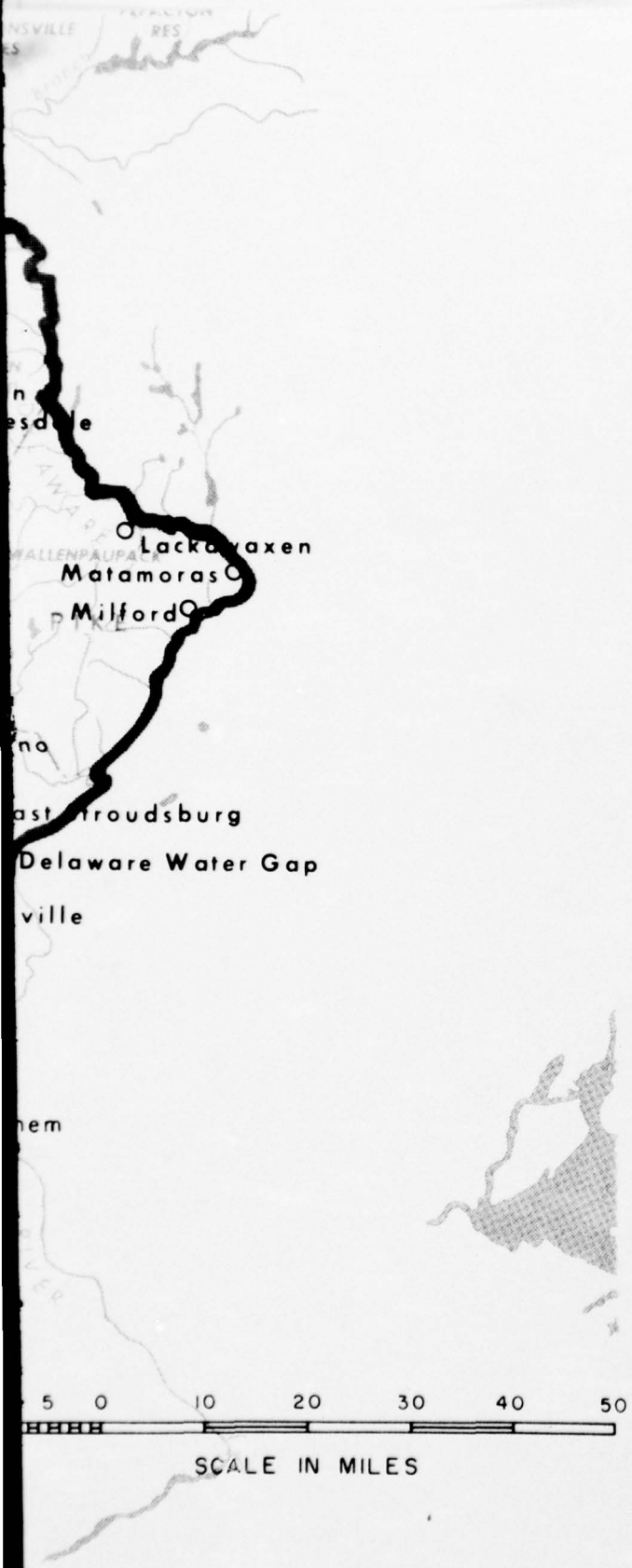
The dividing line of the Appalachian Plateau Physiographic Province splits Lackawanna, Luzerne and Schuylkill Counties in the south and west, from Wayne, Pike, Monroe and most of Carbon Counties in the east. The former are called "the Anthracite Counties" herein; the latter, "Poconos Counties." The terrain of the eastern counties is dominated by the Pocono Mountains of the Southern New York section of the Appalachian Plateau Province. The terrain of the western counties is characterized by the undulating pattern of steep-sided ridges and narrow valleys associated with the Blue Mountain section of the Valley and Ridge Province.

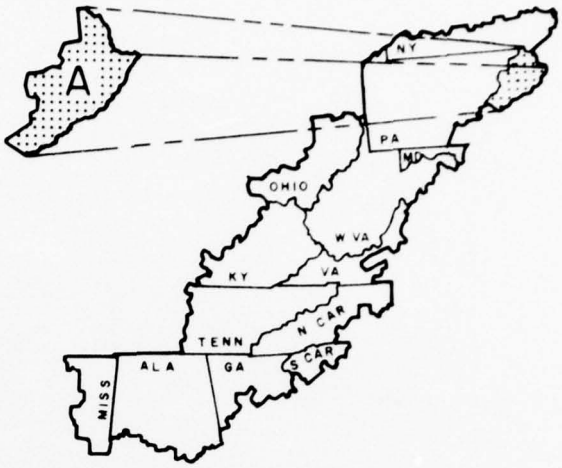
The water sub-region is underlain by rocks of the Devonian, Mississippian and Pennsylvanian ages. These rocks are predominantly shale, with interbedded limestone, siltstone and sandstone. Glacial material has been deposited in the major stream valleys. Groundwater occurs in the inter-granular pore spaces of the glacial alluvium deposits, and in fractures and folds of the bedrock units. These fractures have resulted from major faulting in the southern part of the water sub-region, and folding of the bedrock in the western parts.

In this area, from the Shawangunk conglomerate upward, rock formations of the Silurian to Pennsylvanian Age are folded into a series of anticlines and synclines. Anticlines are arches of stratified rock in which the beds or layers dip in opposite directions. Synclines are formed by rock strata dipping toward a common line.

Much of the originally deposited material has been eroded; only the more resistant rocks of the anticlines and synclines remain. Remaining material includes the Allegheny Formation consisting of irregular beds of anthracite. Deep mining of this anthracite sub-strata was the basis for economic development of the Anthracite Counties in the past.

Binghamton
N
Carbondale
Prompton
Honesdale
Archibald
Hawley
Dickson
Olyphant
Scranton
Dunmore
Old Forge
Avoca
Lackawax
Matamoras
Wyoming
Duryea
Pittston
Milford
Kingston
Luzerne
Wilkes-Barre
Nanticoke
& Forty Fort
Tobyhanna
Pocono Lake
Mt. Pocono
Nescopeck
Wapwallopen
Bartonsville
East Stroudsburg
Hazleton
Stroudsburg
Delaware Water G
Weston
Lansford
Jim Thorpe
Brodheadsville
Wiessport
Lehighton
Coaldale
Girardville
Ashland
Frackville
Tamaqua
Palmerton
Port Carbon
St. Clair
Pottsville
Tremont
Orwigsburg
Schuylkill Haven
Tower City
Cressona
Easton
Allentown
Bethlehem
Pine Grove
Port Clinton
10 5 0 10
SCALE





VICINITY MAP

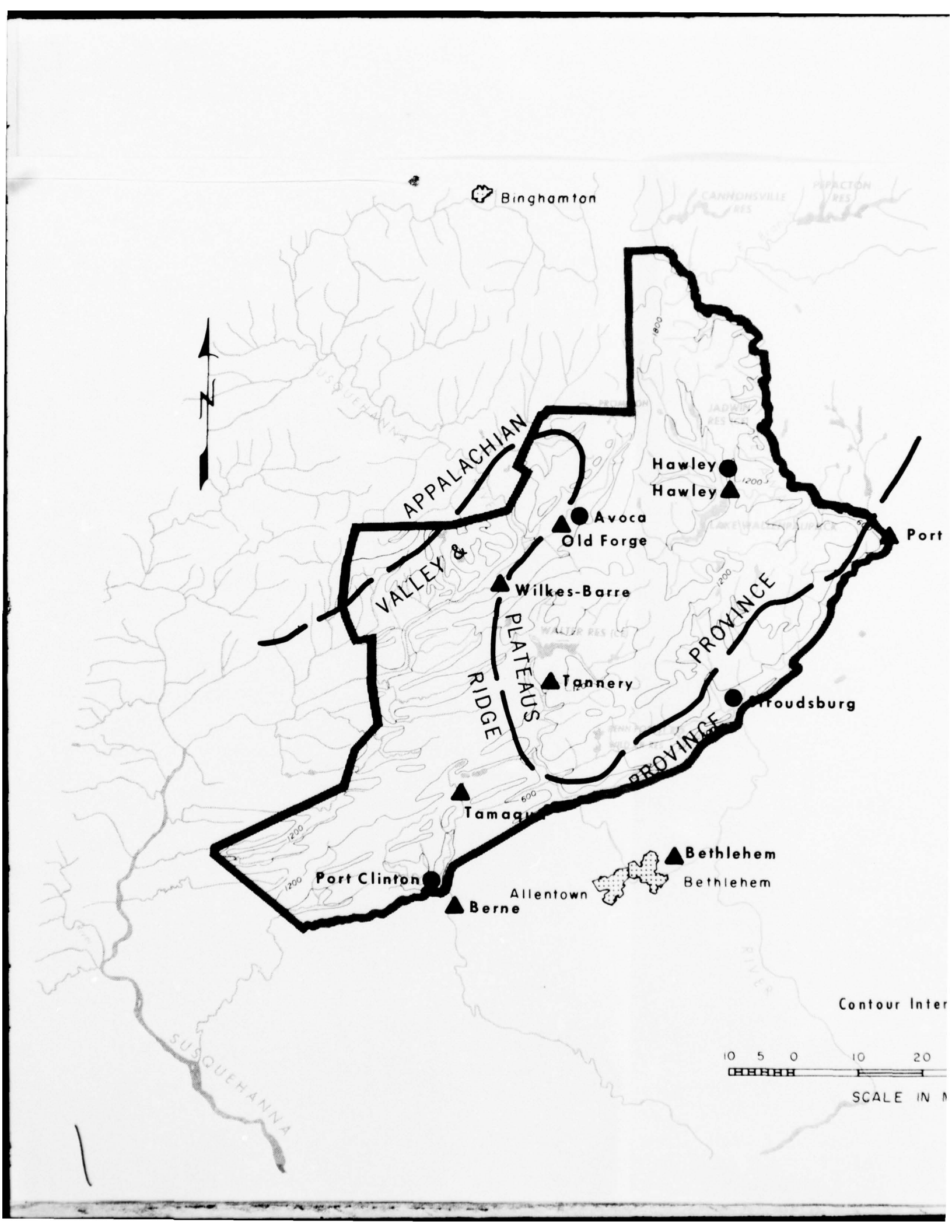
REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA

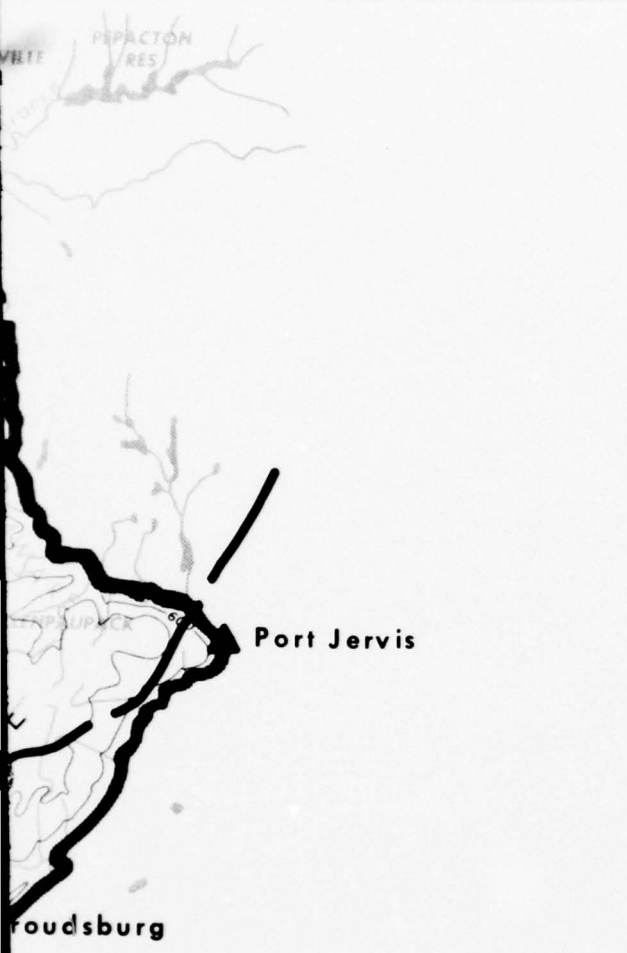
WATER SUB - REGION A

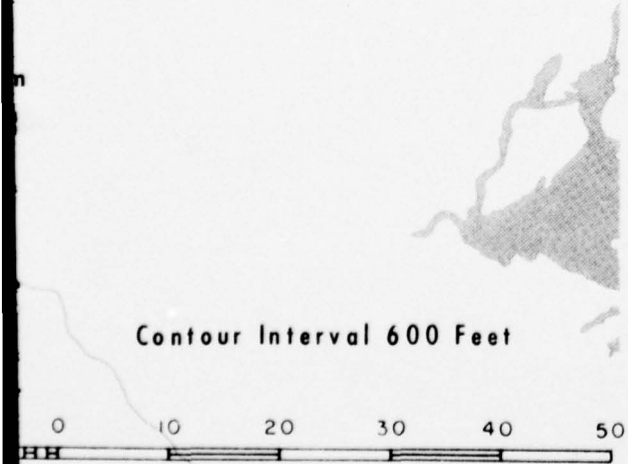
LOCATION MAP

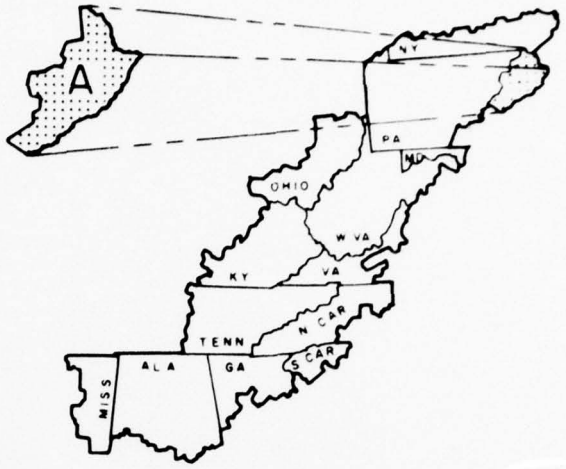
OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-1-3 FIGURE 1-1


Binghamton
N
APPALACHIAN
VALLEY &
RIDGE
PLATEAUS
PROVINCE
PROVINCE
Hawley
Hawley
Avoca
Old Forge
Wilkes-Barre
Tannery
Stroudsburg
Port
Tamaqua
Bethlehem
Bethlehem
Allentown
Port Clinton
Berne
SUSQUEHANNA
Contour Inter
10 5 0 10 20
SCALE IN M







VICINITY MAP

LEGEND

- PRECIPITATION STATIONS
- STREAM GAGING STATIONS
- PHYSIOGRAPHIC BOUNDARY

REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA

WATER SUB - REGION A

PHYSICAL FEATURES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-1-5

FIGURE 1-2

Anthracite Mining

Mine drainage characteristics depend on the type of mining activity involved. These are of three major types: (1) shaft and slopes; (2) drift and auger holes, and (3) strip mines.*/

Shaft and slope mines remove anthracite through either a vertical or sloping entry to the unexposed coal seam. Water from this type of mine is discharged into surface drainage by pumping.

Drift mines and auger holes are driven into the outcrop of the seam and normally follow the same inclination of the seam. Gravity flow discharge is possible if the lower elevation of the seam is near the outcrop; otherwise, pumping is involved.

Strip mining involves removal of the soil and rock overburden where coal is exposed for mining. If the strip mine is above the surrounding water table, water is generally disposed of by gravity flow. Pumping of acid mine water is necessary if the strip mine is below the surrounding drainage level.**/

Each of the above types of mining activity presents a potential threat of acid mine drainage. The problem is particularly acute with abandoned mine openings or exposed coal surfaces. Notable attempts have been made since the 1930's on a relatively large scale to seal abandoned mine openings. These seals deteriorate in time, however, and most of the original benefits of mine sealing are lost.

The problem is compounded by pressure of acid water on these seals. This pressure occurs when a mine seal is below the surrounding water table. Instances are documented where water pressure has been so great as to "pop" the mine seal, thus dispelling thousands of tons of acid water into surface drainage.

As shown in Figure 1-3 on the following page, the ridges and valleys of Lackawanna, Luzerne and Schuylkill Counties and the western part of Carbon County are underlain by vast deposits of anthracite. Mineral resources in the Poconos area are limited to less valuable products, such as clay, gravel and stone.

---

*/ Contained in Acid Mine Drainage, a report prepared for the Committee on Public Works, House of Representatives, by the Public Health Service, U.S. Department of Health, Education & Welfare, Washington, D.C., U.S. Government Printing Office, 1962, p. 4.

**/ Ibid., p. 4.

PRECEDING PAGE BLANK-NOT FILMED

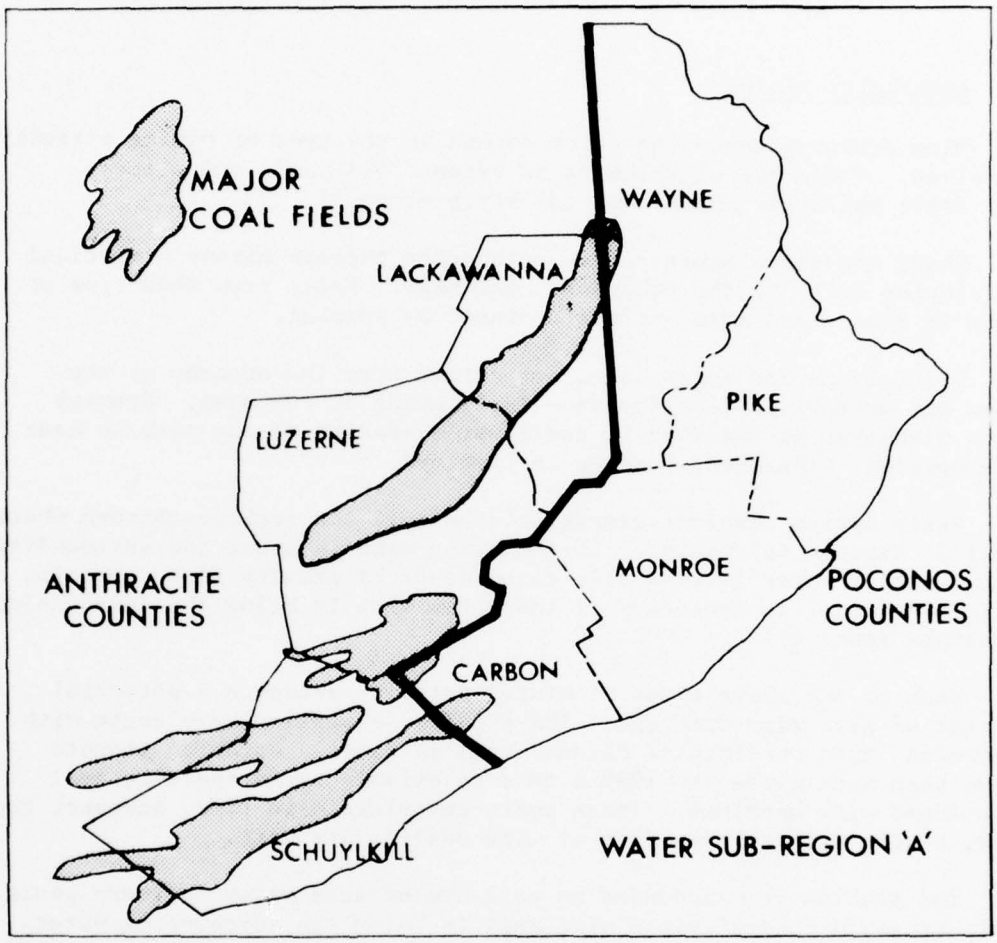


Figure 1-3 - Anthracite Deposits in Water Sub-region A

Over 85 percent (estimated at 19.3 billion net tons) of the nation's total known anthracite reserves lay almost wholly within the boundaries of Lackawanna, Luzerne and Schuylkill Counties. These reserves have had far-reaching effects on the physical, economic and cultural development of the entire water sub-region, as will be discussed below.

Climate

Due to its location at about 40 degrees north latitude, the region enjoys a temperate climate. The average year-round temperature is about 48 degrees. The warmest and coldest months have average temperatures of 72 and 20 degrees, respectively.

Average precipitation is about 43 inches distributed evenly throughout the year. Although precipitation is generally adequate, there have been periods of severe drought in the water sub-region, having a duration of several years. Less severe droughts have occurred during hot, normally humid, summer months.

Usually, maximum temperatures are reached during July or August. Upon occasion, the temperature may exceed 100 degrees F. Minimum temperatures for the area during December, January and February are usually below freezing. Temperatures occasionally fall below zero degree, especially in the higher elevations.

The annual snowfall during the period of record has been variable, ranging from 5 to over 65 inches. Heavy snowpack accumulations during prolonged low temperature periods pose potential flood threats. If the snowpack is rapidly dissipated by abnormally warm temperatures, with coincident rainfall, a major flood may result.

Flooding in Water Sub-region A is caused by several types of storms. Tropical storms, usually hurricanes, come in late summer and early fall. Extra-tropical storms occur in both warm and cold months. Sudden and violent thunderstorms, that occur in warm weather, are also extra-tropical in nature. They may give several inches of precipitation, although this is usually highly localized.

Precipitation data for a number of storms that have occurred in the general vicinity of Water Sub-region A are recorded and analyzed in the Corps of Engineers' report entitled: Storm Rainfall in the United States; Depth-Area-Duration Data. The date of occurrence of each storm, estimated accumulation of rainfall for 24- and 48-hour durations, and the total storm period over a 500-square-mile area appears in Table 1-1.

TABLE 1-1

STORM PRECIPITATION DATA FOR SELECTED LOCATIONS, WATER SUB-REGION A

Storm	Location of Center	Depth in Inches		Total
		24 Hours	48 Hours	Storm
20-24 Aug 1933	Peekamoose, N.Y. (60 mi. northeast)*/	8.7	9.9	12.6
6-10 Jul 1935	Hector, N.Y. (100 mi. northwest)*/	9.3	11.6	12.4
19-23 May 1942	Mahanoy City, Pa. (In Water Sub-region A)	5.6	6.7	7.7
11-15 Aug 1955	Slide Mt., N.Y. (70 mi. northeast)*/	6.5	10.7	11.5
17-20 Aug 1955	Westfield, Mass. (160 mi. northeast)*/	13.4	17.2	17.3

*/ Approximate distance and direction from the center of Water Sub-region A.

The U.S. Weather Bureau has collected and published data for numerous stations in the area. Four of these stations, Hawley, Stroudsburg, Port Clinton, and Avoca (the Wilkes Barre/Scranton Airport), have long-term records that are considered representative of the water sub-region. Precipitation data for selected stations located on Figure 1-4 are shown as follows:

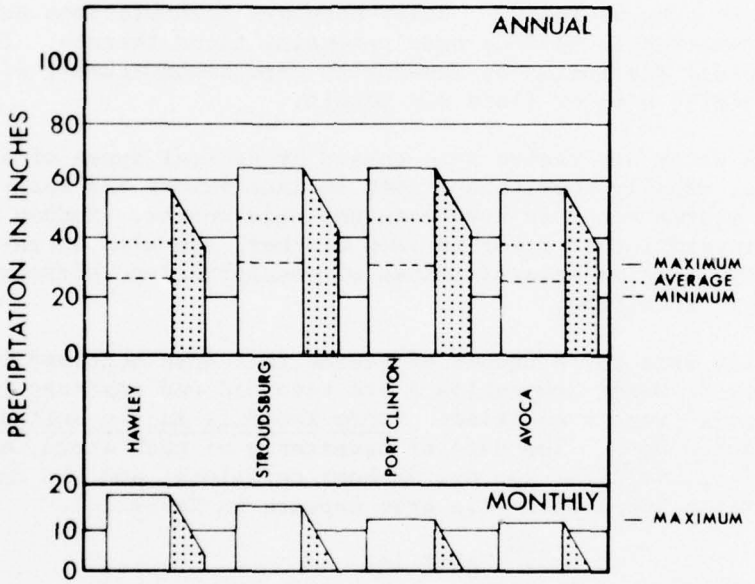


Figure 1-4 - Precipitation Data for Selected Stations in Water Sub-region A.

Runoff

Runoff data for stream gaging stations with over twenty years of record are shown in Table 1-2.

TABLE 1-2

STREAM GAGING DATA AT KEY STATIONS IN WATER SUB-REGION A

Stream and Station	Period of Record	Drainage Area (Sq.mi.)	Mean Runoff	Annual Runoff			
				Maximum of Record		Minimum of Record	
				Year	Inches	Year	Inches
Lackawaxen R. Hawley, Pa.	1908-65	290	22.00	1952	35.10	1965	9.56
Lehigh R. Tannery, Pa.	1914-59	322	28.13	1928	44.75	1931	15.64
Lehigh R. Bethlehem, Pa. (a)	1929-65	1,279	23.84	1952	42.28	1965	12.36
Little Schuylkill R., Tamaqua, Pa. (a)	1920-65	42.9	29.35	1952	53.23	1965	12.70
Schuylkill R. Berne, Pa.	1947-65	355	25.98	1952	45.35	1965	12.27
Lackawanna R. Old Forge, Pa. (a)	1939-65	332	21.40	1956	32.00	1965	7.94
Susquehanna R. Wilkes-Barre, Pa.	1899-65	9,960	17.84	1928	28.81	1965	8.43

(a) Adjusted for upstream storage, diversion, etc.

Runoff from the water sub-region averages about 25 inches per year. This is equivalent to about 1.2 million gallons per day (mgd) from each square mile of drainage area, or about 5,300 mgd from the total area. The streamflow is generally of good quality, suitable for water supply and other uses, except where it is contaminated by wastes from urban, industrial, and/or coal mining and processing sources.

Delaware River Basin

The Delaware River extends from the Catskills in New York to the Atlantic Ocean, draining a long, narrow basin 40 to 80 miles wide. It cuts a deep gorge through the Catskills and the Appalachian Plateaus Province in New York State. At Delaware Water Gap, it pierces nearly vertical sandstone walls and passes on through scenic farm and forest land. For 150 miles, from Hancock, New York, to the Delaware state line, it forms the eastern boundary of the Commonwealth of Pennsylvania. Within that state, it drains 6,442 square miles, approximately a third of which is within the Appalachian Region.

The Delaware River Basin Commission (DRBC) has been established to oversee the comprehensive development of the basin's water resources. Of particular interest to the Delaware River Basin Commission is the Tocks Island Reservoir and the surrounding Delaware Water Gap National Recreation Area. These projects are expected to spur the tourist industry of Monroe and Pike Counties.

On the main stem of the Delaware River, water quality is excellent for the present needs of the region. It is therefore sought by eastern seaboard cities whose increasing demands require them to search for new supplies. In part, the competition of New York, New Jersey and Pennsylvania cities brought about the formation of the Delaware River Basin Commission. The Commission endeavors to regulate use of the basin's water supplies, clean up existing sources of pollution, and develop the abundant water-oriented recreation and economic resources of the River Basin.

Susquehanna River Basin

The Susquehanna is the longest river draining into the Atlantic Ocean in the United States. Rising in Otsego Lake, in central New York, it dips into the north portion of Susquehanna County and back into New York before it finally bends southward through Bradford County. It flows to the southeast through the Allegheny Plateau and breaks into the Ridge and Valley Province of the Newer Appalachian Mountains at Pittston, where it is joined by the Lackawanna River from the northeast.

From there, following a longitudinal valley, it moves southwesterly to Sunbury, where it is joined by the 228 mile long West Branch River which rises in the Appalachian Plateau country of northern Indiana County.

From Sunbury, it flows south until it is joined by the Juniata River flowing from the west through the Ridge and Valley Province. Just below this confluence, it cuts through Blue Mountain near Harrisburg, and emerges in an impressive mile-wide bed that moves southeasterly to the Chesapeake Bay and on to the Atlantic Ocean.

Acid mine water is the legacy of anthracite mining in the deep mines of the Lackawanna and Wyoming Valleys from Carbondale to Nanticoke. As mines were abandoned, they were filled with water. This water ultimately overflowed into adjacent mines or into the Susquehanna and its tributaries. Pumping waters from these abandoned pools was necessary to continue operations in some active mines. The pumping resulted in serious water pollution in 1961.

Transportation Networks

The rugged terrain of Water Sub-region A has had an adverse effect on the development of transportation routes. The influence of the mining industry, however, and this industry's need for good rail transportation has partially overcome this difficulty. Modern concepts of highway design and improved construction methods are rapidly overcoming the remaining problems.

A network of state and interstate highways connects the population and industrial centers of the region with the large urban markets of the Northeast Corridor. The seven counties are linked to most economic centers in the northeastern states via Interstate Routes 80, 81, 81E and 84, as well as the northern extension of the Pennsylvania Turnpike.

Completion of the interstate highway network, shown on Figure 1-5, will provide most of the water sub-region, particularly the industrial area, with first-rate highway access in all directions. There remains a need, however, for more emphasis on improvement of feeder and access roads in the area.

The area has both air and rail service. Four major airlines provide passenger and freight service to and from the Wilkes-Barre-Scranton and Hazleton airports. Seven railroads connect the water sub-region with the industrial and commercial centers of the east and mid-west.

As is evident in Figure 1-6, the railroad network was developed primarily to service the anthracite mining region, with only one rail line crossing through Monroe and Pike Counties. At present, the railroads provide adequate freight service throughout the region, but there is no local passenger service north of Pottsville or south of Scranton.

Rail and air facilities can be expected to continue to develop. Contracts have been awarded for expansion of runway facilities at Wilkes Barre-Scranton Airport to accomodate jets (see Figure 1-5).

Improvements at Hazleton and three of the smaller general aviation airports near Pottsville, Metamoras and Mt. Pocono are planned. As a consequence of such development, Water Sub-region A's growth potential should not be inhibited by inadequate transportation facilities.

3. RESOURCES DEVELOPMENT

Human Resources

The discovery of coal in the early 1800's brought the initial influx of people into the anthracite region. Villages and towns were established at or near the mines. As more coal was needed to satisfy the progress of the industrial revolution, additional mines were opened. Railroads replaced the barges and canals that were originally used for transportation of coal. Repair shops and maintenance facilities were also located in the area.

Population grew steadily until it peaked at about 1.1 million in 1930. Since that time, the importance of hard coal as a fuel has declined, and the mining operation has become increasingly mechanized. The result has been a steady drop in mining employment over time. This decline, in turn, has led to a net out-migration of the population from the anthracite-producing portion of the water sub-region.

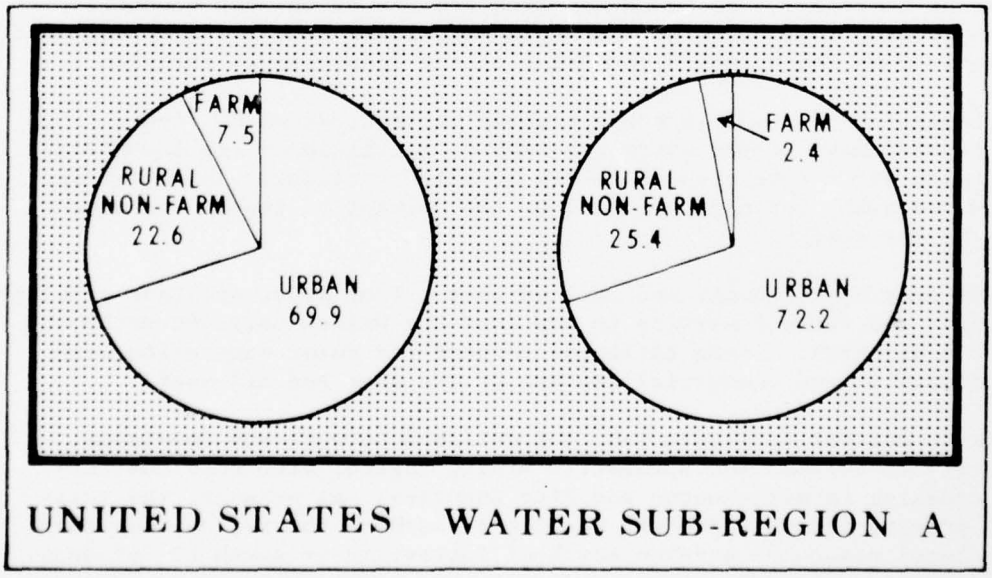
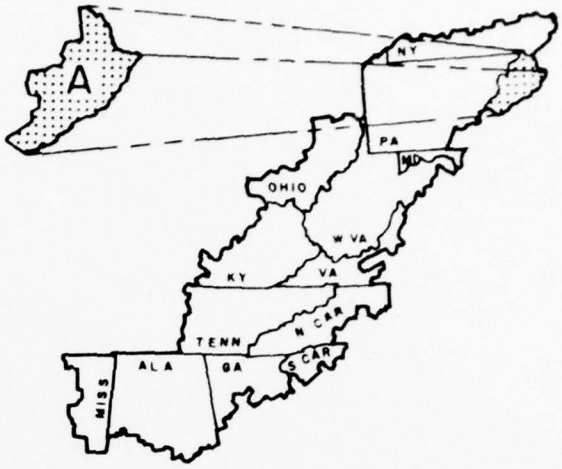


Figure 1-7 - Distribution of Urban, Rural Non-farm and Farm Population in Sub-region A Compared to the United States, 1960.

Binghamton
Prompton
Carbondale
Archbald
Hawley
Dickson
Olyphant
Scranton
Dunmore
Old Forge
Avoca
Wyoming
Duryea
Pittston
Kingston
Luzerne
Wilkes-Barre
Nanticoke
& Forty Fort
Tobyhanna
Pocono Lake
Mt. Pocono
Matamoras
Milford
Nescopeck
Wapwallopen
Bartonsville
East Stroudsburg
Hazleton
Stroudsburg
Delaware Water Gap
Weston
Lansford
Jim Thorpe
Wiessport
Lehighton
Coaldale
Frackville
Tamaqua
Palmerton
Girardville
Ashland
Mt. Carbon
St. Clair
Pottsville
Tremont
Orwigsburg
Schuylkill Haven
Tower City
Cressona
Pine Grove
Port Clinton
Easton
Bethlehem
Allentown
Reading
Harrisburg
Philadelphia
PENNSYLVANIA TURNPIKE
(TOLL)
TVDK
(N.E. EXT.)
10 5 0 10 20
SCALE IN M



VICINITY MAP

LEGEND

- INTERSTATE HIGHWAY or TOLL ROAD
- FEDERAL HIGHWAY
- STATE HIGHWAY
- APPALACHIAN CORRIDOR
- INCLUDES JET SERVICE
- SCHEDULED PROP SERVICE

REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA

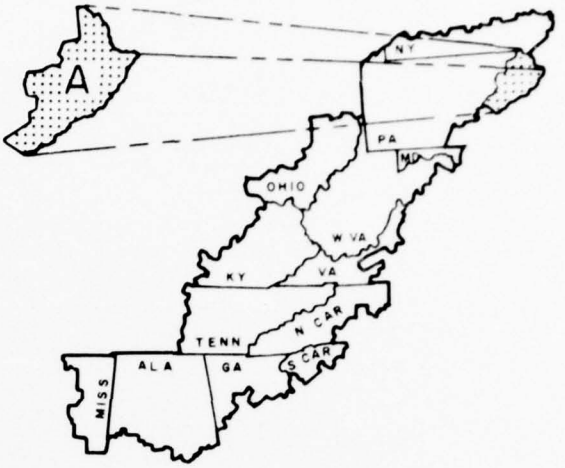
WATER SUB - REGION A

HIGHWAYS & AIRPORTS

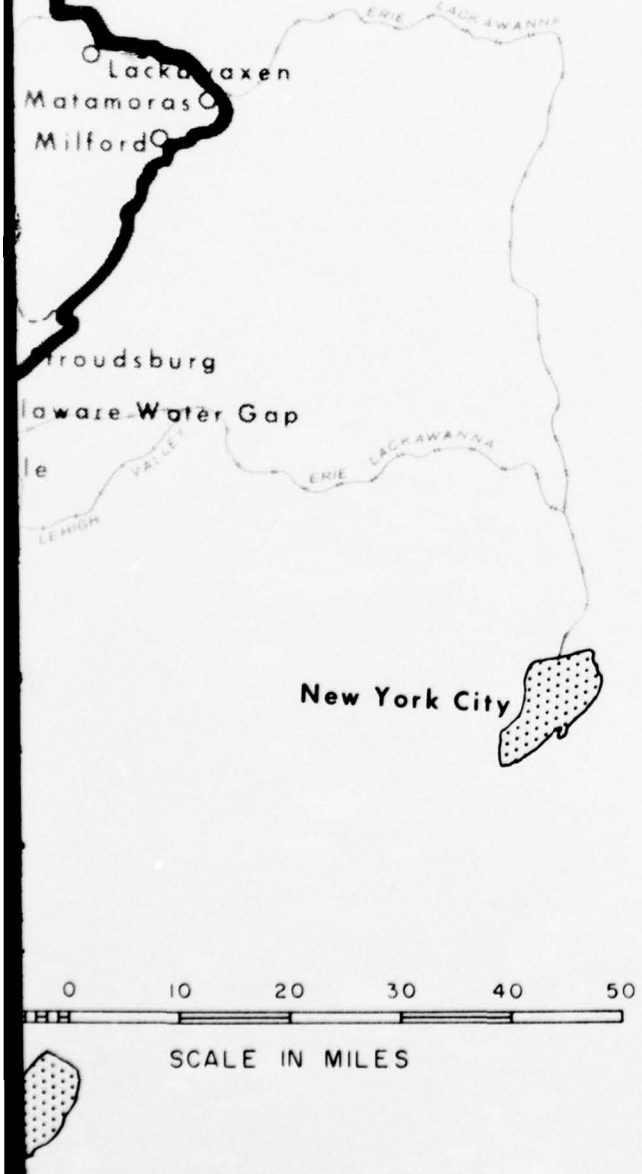
OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-1-15 FIGURE 1-5

Binghamton
N
Carbondale
Prompton
Honesdale
Archibald
Hawley
Dickson
Olyphant
Scranton
Dunmore
Old Forge
Avoca
Lackawaxen
Matamoras
Wyoming
Duryea
Milford
Kingston
Pittston
Luzerne
Wilkes-Barre
Nanticoke
& Forty Fort
Tobyhanna
Pocono Lake
Mt. Pocono
Nesquopeck
Wapwallopen
Bartonsville
East Stroudsburg
Hazleton
Stroudsburg
Delaware Water Gap
Weston
Lansford
Jim Thorpe
Brodheadsville
Wiessport
Mahanoy City
Lehighton
Girardville
Coaldale
Ashland
Frackville
Tamaqua
Palmerton
Port Carbon
St. Clair
Pottsville
Easton
Tremont
Orwigsburg
Schuylkill Haven
Tower City
Cressona
Bethlehem
Allentown
Pine Grove
Port Clinton
Reading
Harrisburg
10 5 0 10 20
SCALE IN M
Philadelphia



VICINITY MAP



REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA

WATER SUB - REGION A

RAILROADS

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-1-17 FIGURE 1-6

The 1960 population of the water sub-region was 884,381. Of this total, 72 percent were classified as urban; and the remainder, rural. As shown on the preceding page, II-1-14, in Figure 1-7, 2 percent of total population were farm residents; 25 percent were rural non-farm.

The Anthracite Counties are not only more populous than the other counties, they are also more urbanized. As indicated below in Figure 1-8, the average urbanization in the western three county group (Anthracite Counties) is 78 percent; that is, 78 percent of the people live in communities of 2,500 or more. The eastern counties (Poconos Counties), average only 53 percent.

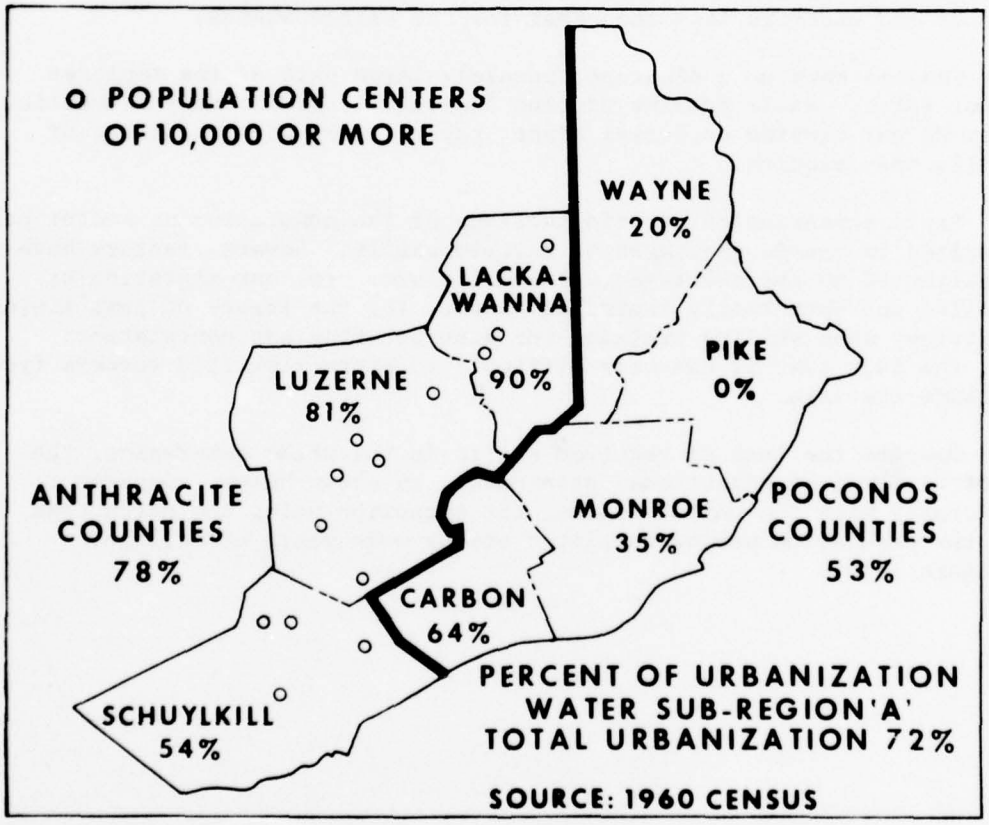


Figure 1-8 - Population Centers and Percent of Urbanization, Water Sub-region A.

The difference is further emphasized by the distribution of cities. The Anthracite Counties have 13 population centers of 10,000 or more, including the Standard Metropolitan Statistical Areas (SMSAs) of Scranton (1960 population 111,442) in Lackawanna County; and Wilkes-Barre (63,551) - Hazleton (32,056) in Luzerne County.

In the Poconos Counties there are no single population centers over 7,500; however, the combined population of the boroughs of Stroudsburg and East Stroudsburg was in excess of 13,00 in 1960. With the exception of the western end of Carbon County, the four eastern counties are rural.

As shown in Figure 1-9, Water Sub-region A has a larger proportion of its population concentrated in the over-40 year age group than has the United States. By contrast, that portion of the area's population age 24 and under is less than that for the United States.

Females make up a disproportionately large part of the employed labor force. While females provide low-wage labor for many industries, they do not provide potential higher paying firms with the kinds of skills they require.

Rapid expansion of certain portions of the manufacturing sector has resulted in severe shortages of certain skills. Several factors have contributed to the shortages. These include: (a) out-migration of skilled and potentially trainable people; (b) the legacy of past mining activity, when skilled training for manufacturing was nonexistent; (c) the fact that it has been difficult to attract skilled workers from outside the area.

Despite the lack of required skills in the water sub-region, the general level of educational attainment, as shown below, compares favorably with the United States, the exception being the percentage of the population having completed one or more years of college. (Figure 1-10.)

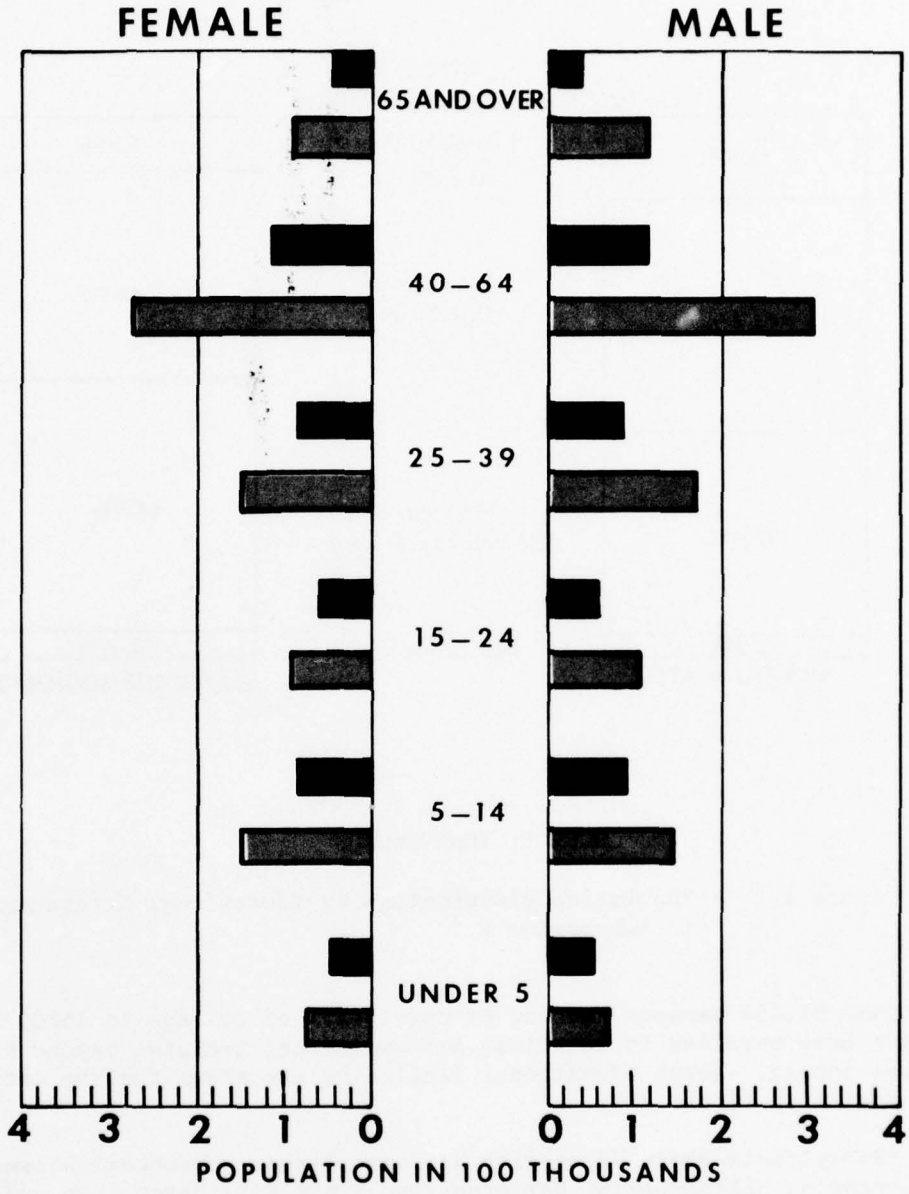
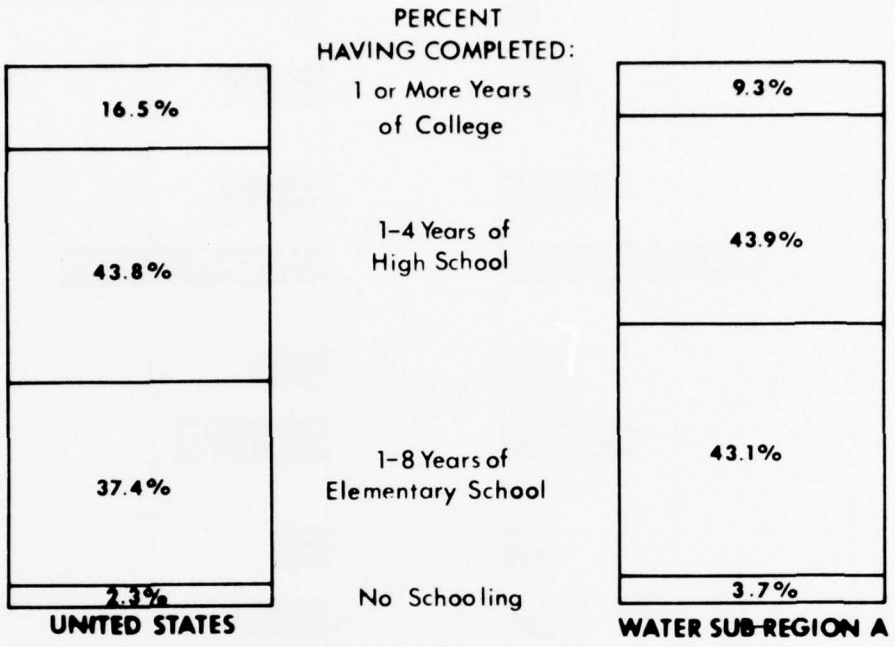


FIGURE 1-9 1960 POPULATION DISTRIBUTION BY AGE & SEX



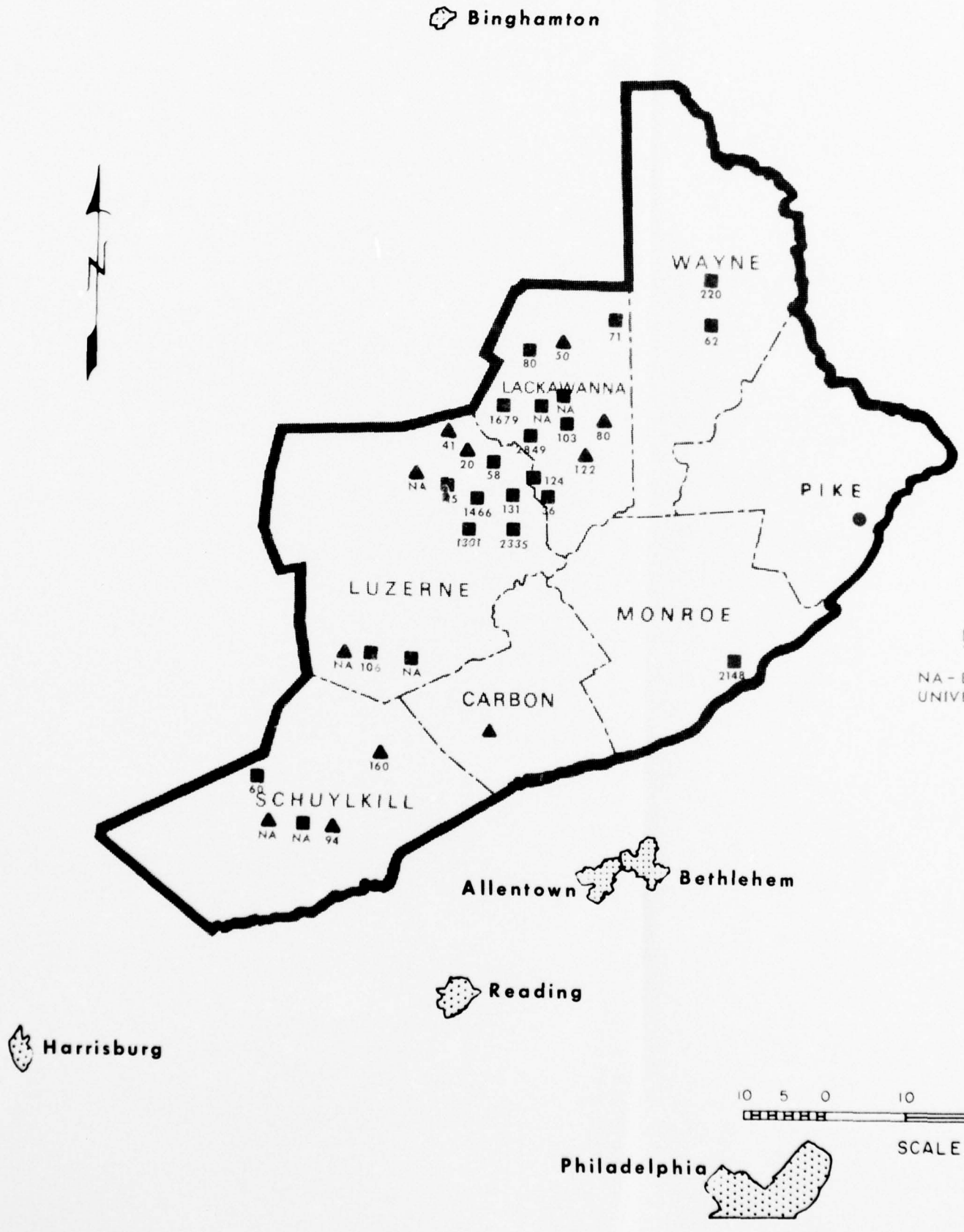
SOURCE: 1960 CENSUS

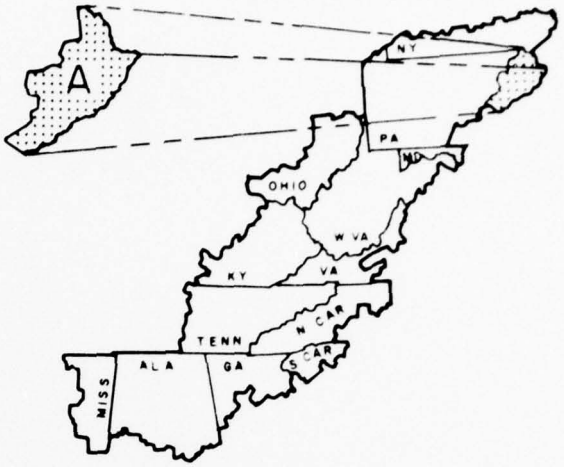
Figure 1-10 - Population Distribution by Educational Attainment in Sub-region A.

Over 51,250 persons had one or more years of college in 1960. Many others have enrolled in technical and vocational training beyond high school levels. These educational facilities are shown for the water sub-region in Figure 1-11.

Pennsylvania State University has established commonwealth campuses in Scranton, Wilkes-Barre, Hazleton, and Schuylkill Haven. In addition to a State College located in East Stroudsburg, there are five other small liberal arts colleges in the water sub-region. Economic Development Administration (EDA) occupational training programs are currently underway in Scranton, with two more being planned for Hazleton and Wilkes-Barre.

Shifts in the occupational structure of the Water Sub-region are expected to occur in the near future. The number of future laborers required is expected to decline slightly, resulting largely from increases in skilled labor requirements. At the same time, the need for clerical help is expected to rise sharply.


Binghamton
WAYNE
220
62
71
80
50
LACKAWANNA
1679
NA
NA
103
80
2849
41
20
58
122
124
NA
5
1466
131
56
1301
2335
PIKE
LUZERNE
MONROE
NA
106
NA
2148
CARBON
160
60
SCHUYLKILL
NA
NA
94
Allentown
Bethlehem
Reading
Harrisburg
10 5 0 10 20
Philadelphia
NOTE
NA - ENROLL
UNIVERSITY



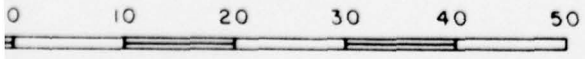
VICINITY MAP

LEGEND

- COUNTIES WITHOUT TECHINICAL / VOCATIONAL SCHOOLS OR COLLEGES
- TECHINICAL OR VOCATIONAL SCHOOLS
- SENIOR AND JUNIOR COLLEGES

NOTE

NA - ENROLLMENT AT MAIN CAMPUS OF UNIVERSITY OR OTHERWISE NOT AVAILABLE



SCALE IN MILES

REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA

WATER SUB - REGION A

HIGHER EDUCATION FACILITIES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-1-23 FIGURE 1-11

Skill requirements of existing and prospective industry must be met not only through increases in the size of the labor force, but educational training more attuned to the skill needs of the area. Improvement and expansion of vocational and higher education facilities is necessary to achieve this end.

Minerals

Water Sub-region A originally contained deposits of over 19 billion tons of anthracite. Recoverable reserves as of January 1960 were estimated to be in excess of 6 billion tons. Paradoxically, the presence of these vast mineral reserves is not expected to be of importance in the future as a source of employment and income in the Water Sub-region.

Total annual anthracite production in Pennsylvania decreased from a peak of over 90 million tons in 1920 to less than 16 million tons in recent years. Predictions are that production will continue to decline in the future.

Unfortunately, the anthracite industry will have a continuing depressing effect on the future economy of the water sub-region. This effect partially stems from the thousands of acres of land that have been left blighted by open pits and piles of mine waste, resulting from over 100 years of indiscriminate mining and processing operations.

Rigidly enforced state clean stream and mine operating laws are keeping the damaged areas from spreading. Plans for restoration of previously blighted lands and polluted streams are being extensively studied by federal, state and local authorities. In addition, there has been a significant investment of federal and state funds in the Anthracite Counties. This investment supports projects for extinguishing mine and spoil bank fires, and for filling mine voids in areas where subsidence has occurred.

Other mineral production in Water Sub-region A is mainly in construction minerals, mostly consumed within the water sub-region. Mining constituted five percent of total employment in 1960. This is 2.5 times the average for the Appalachian Region, and five times the National average in the same year.

Lands and Environmental Aspects

Lands

The total land area of the sub-region is 2,837,100 acres. The present agriculture acreage is 2,593,000 and non-agriculture amounts to 244,100. The present agricultural and forest land use acreage is as follows:

cropland 352,500; pasture 122,100; state and private forest and woodland 1,924,700; and other land 193,700. There are no acres of National Forest land in the sub-region. Land use is depicted in Figure 1-12.

Non-agricultural land includes federal land, urban and built-up areas, water areas less than forty acres, and streams less than one-eighth mile wide. The water area amounts to 11,000 acres, or about 0.4 percent of the total land area.

While two-thirds of the water sub-region is in forest and woodland, past use, land clearing, livestock grazing, improper timber cutting practices, and forest fires have destroyed much of the humus and the organic matter in the upper surface layer of the soil. These conditions have left three-fourths of the forest land in a poor hydrologic condition and have materially reduced its capacity to absorb and store precipitation. About 80 percent of the forest land has a high to medium potential to improve hydrologically if given proper management and protection. The principal forest cover types are oak-hickory and maple-beech-birch.

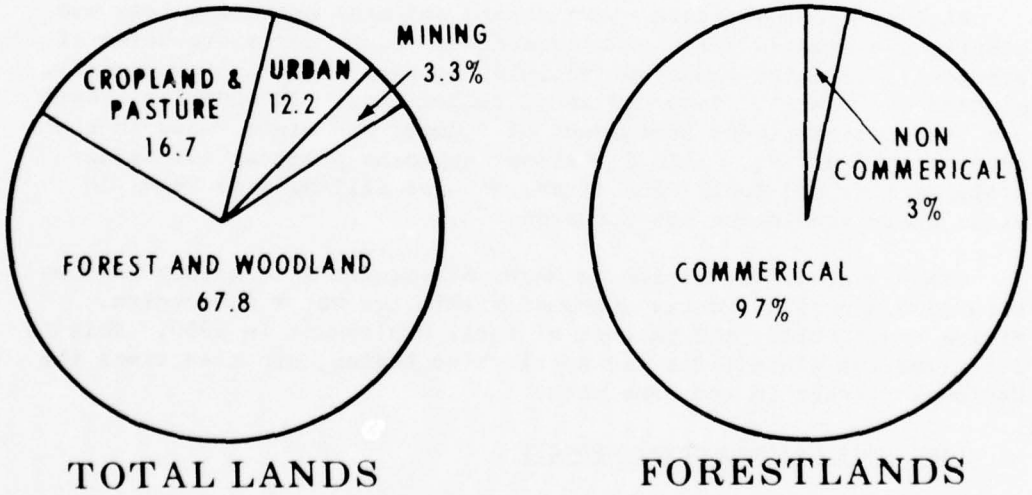


Figure 1-12 - Land Use in Sub-region A.

About 97 percent of the forest lands are capable of producing commercial timber. The U.S. Department of Agricultural's Conservation Needs Inventory indicates an increase in forest acreage of about 27,000 acres between 1958 and 1975. This trend will probably continue at about the same rate. Most of the acreage increase will come from abandoned crop or pastureland.

The total agricultural land in the sub-region is 2,593,000 acres. This acreage is expected to decrease to approximately 2,530,600 acres by 1975. The expected reduction in agricultural land will be mainly due to increases in either federal or state-owned land, land occupied by reservoirs, or land converted to urban development. As of June 30, 1967, the U.S. Soil Conservation Service has completed soil surveys on about 1.5 million acres of the sub-region's agricultural land. Of the inventorical acreage, only about 24 percent of the sub-region (capability Classes I, II, and III) is suited for intensive long-term cultivation. The remaining 76 percent is suited only for permanent type vegetation such as grass, trees and shrubs for pasture, grazing, forest and wildlife purposes. The percent of land in this water sub-region in each of the capability classes is shown in Figure 1-13.

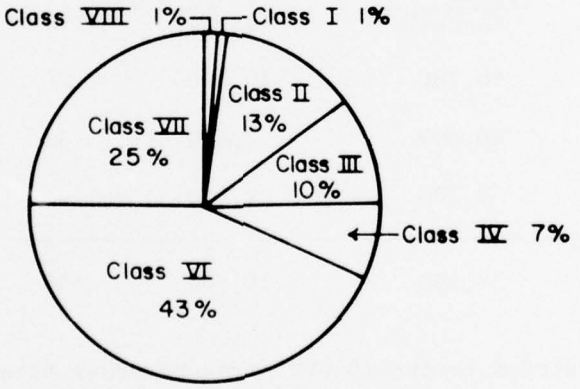


Figure 1-13 - Percent of Inventory Acreage by Land Capability Class, Water Sub-region A.
Distribution of Sub-region A Agricultural Land by Land Capability Classes as shown in the National Conservation Needs Inventory by the USDA.

Land Disturbance

Although mining has accounted for only 3.3 percent of the land use in Water Sub-region A as a whole, the disturbed areas cover over 6 percent (88,000 acres) of the surface area in Lackawanna, Luzerne and Schuylkill Counties. Many of the great open pits, massive spoil banks and culm piles are located along frequently used transportation arteries near, or in, the major population centers. Along with deep mine drainage, they are a major source of stream and groundwater pollution in this water sub-region. They dominate and blight large sections of a landscape which was once comparable in natural beauty with any area in the northeastern United States.

Many of the communities in Water Sub-region A grew during the late 19th and early 20th Centuries around mines and mills characteristic of industrial growth in that era. Urban lands in the Anthracite Counties have suffered from the effects of this past mining activity. Indication of the extent of such damage is shown as follows.

County	Total Urban Area in Coal Fields (acres)	Urban Area Disturbed by Mining (acres)	(%)
Lackawanna	50,200	10,300	20
Luzerne	20,800	2,600	13
Schuylkill	8,100	2,100	25
3-County Total	79,100	15,000	19

In addition to the 15,000 acres of urban area that have been spoiled for future use as residential, industrial, or commercial sites in the Anthracite Counties of Water Sub-region A, there are almost 73,000 acres of pits, spoil-banks and culm piles in the adjoining rural areas. Programs designed to restore these lands and streams are vital to attract and support future economic growth in the area.

Many potential commercial, industrial and residential sites cannot be developed unless coal strips are reclaimed, mine subsidence corrected and mine fires extinguished. In most of these areas mine drainage

pollution is also serving as an obstacle to development. Except for the western part of the Carbon County, the remainder of Water Sub-region A has not been oriented to coal mining.

Land available for industrial and urban expansion in the sub-region is ample for needs through 1980, although some deficiencies in certain localities, such as the Greater Scranton Area, are evident.

Environmental Aspects

The water sub-region has one of the most desirable recreation areas in the northeastern United States. In addition it contains many areas of unique scenic, archeological, historical and natural scenic values. In the counties of Wayne, Carbon, Pike, and Monroe are the Poconos Mountain resort areas that attract thousands of vacationers and tourists annually. Tourism is by far the most important source of employment and income in this portion of the water sub-region. Most of the Poconos area's 85,000 residents are directly or indirectly affected by the tourist industry. The future of the Poconos portion of the water sub-region will be strongly influenced by its recreation potential.

Also important to the future economic growth of this area is the construction of the Tocks Island Dam and Reservoir on the Delaware River. This dam will create a 37-mile long impoundment surrounded by the 72,000-acre Delaware Gap National Recreation Area. This project, which is the first inland national recreation area in the east, is expected to attract an estimated 10 million visitors annually upon completion in 1978. In addition the authorized Mauch Chunk Creek and Brier Creek upstream watershed projects will provide recreation opportunities for 142,000 visitors annually.

The Appalachian Trail follows the ridges bordering the southern part of the sub-region. This trail has achieved national recognition. Development compatible with walking for pleasure and hiking will assure future opportunity for those who wish these types of activities.

Scenic and historical sites are shown in Figure 1-14.

Water Resources Development - Federal

Corps of Engineers

Reservoir Projects. There are three existing major Federal flood control dams in Water Sub-region A. Two of these, General Edgar Jadwin and Prompton, are located in Wayne County. They provide a total of almost 45,000 acre feet of storage for flood control in the Lackawaxen River Basin. Jadwin Dam has a dry reservoir and has never been developed for recreation. Prompton, however, has a fair sized conservation pool (280 acres). Although designed as a single purpose

flood control dam, incidental use of the conservation pool for recreational purposes is permitted. Similarly, the third dam, Francis E. Walter, located on the upper Lehigh River in Luzerne and Carbon Counties , was built as a single purpose project, having flood control storage of 109,000 acre feet, providing protection to the downstream population centers on Lehigh River. As with Prompton, incidental recreational use is presently made of the small (90 acre) conservation pool.

As a result of the comprehensive plan for water resources development in the Delaware River Basin,*/ three multiple-purpose dam and reservoir projects (located in or on the border of Water Sub-region "A"), and modification of the Prompton and Francis E. Walter projects to provide the additional purposes of water supplies and recreation, were authorized and probably will be constructed prior to year 2010.

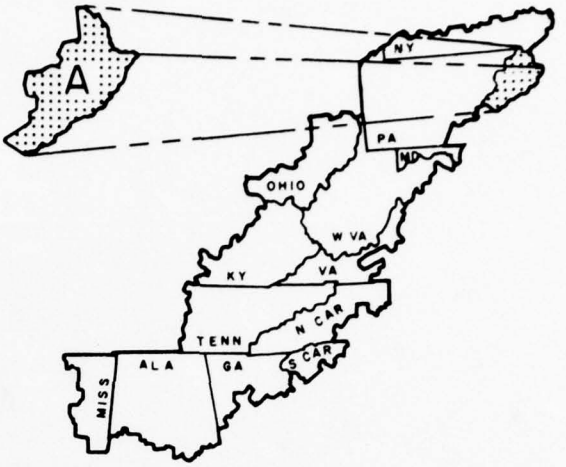
Of the three new structures, Aquashicola and Beltzville, both located in Carbon County on tributaries of the Lehigh River, will provide an additional 47,000 acre-feet of storage for flood protection in the Lehigh Basin, almost 64,000 acre feet of storage for water supplies, and 1,800 acres of reservoir surface for recreational development. Beltzville, which is presently under construction (completion scheduled for 1970), will have a long term storage pool of 947 acres. It is expected to draw 600,000 visitors annually. Aquashicola, which is currently scheduled for construction in 1980, will have a long term storage pool of 840 acres, and will be similarly developed for outdoor recreation.

Tocks Island, one of the largest dam and reservoir projects in the East, is to be built on Delaware River, a few miles above Delaware Water Gap on the eastern border of Monroe County. In addition to power, this impoundment will provide approximately 12,000 acres of water surface. Full development of this immense reservoir for outdoor recreation purposes will be undertaken by the Corps of Engineers and the National Park Service in connection with the construction of the Delaware Water Gap National Recreation Area, which was authorized by Congress under Public Law 89-158, 1 September 1965. This area is expected to ultimately provide facilities for about 10 million visitors annually, and will be the most heavily used public recreation area on the eastern seaboard. At present, acquisition of the properties for DWGNRA is in process; the dam and reservoir project is scheduled for completion in 1978.

---

*/ The comprehensive plan, recommended in House Document No. 522, entitled, "Delaware River Basin, New York, New Jersey, Pennsylvania and Delaware," was adopted by Congress in the Flood Control Act of 1962, Public Law 87-874, 87th Congress, dated 23 October 1962.

Binghamton
WAYNE
Prompton
Prompton Reservoir
Archbald Pothole
Tunkhannock Creek
LACKAWANNA
Scranton Furnaces
Promised Land
George W. Childs
Ricketts Glen
Francis Slocum
PIKE
DELAWARE NATIONAL
Goldsboro
Tobyhanna
Francis E. Walter Reservoir
LUZERNE
MONROE
Tocks Island Reservoir
Nescopeck
Big Pocono
Hickory Run
CARBON
Beltzville
Locust Lake
Tuscarora
Aquashicola
SCHUYLKILL
Lehigh River Gorge
Allentown
Bethlehem
New Y
Reading
Harrisburg
10 5 0 10 20
SCALE IN MILE
Philadelphia



VICINITY MAP

eorge
Childs
IKE

DELAWARE WATER GAP
NATIONAL RECREATION AREA

Tocks Island Reservoir

STATE PARKS
- EXISTING
- PROPOSED

FEDERAL RECREATION AREAS
- EXISTING
- PROPOSED (Major only)
- NATIONAL RECREATION AREA

New York City

0 10 20 30 40 50

SCALE IN MILES

REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA

WATER SUB - REGION A

SCENIC SITES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-1-31 FIGURE 1-14

Modification of the Francis E. Walter dam, to add the purposes of water supply and recreation to the existing flood control project, is scheduled for construction in 1989. The multiple-purpose project will have a long term storage pool of 1,425 acres, and will provide outdoor recreation facilities to accommodate 250,000 visitors annually.

The comprehensive plan for development of the Delaware River Basin calls for the modification of the Prompton project for multiple-purpose use (water supplies, recreation and flood control) after 1980. Recreation development at the modified project, as described in the project document, would accommodate 156,000 visitors annually. The long term storage pool will have an area of 720 acres.

It is expected that, partially as a result of this construction program, the recreation complex (which is now centered in the Poconos in Monroe County) will expand into those portions of the water sub-region both to the north and the south of the Poconos. These areas abound in attractive land resources, but they lack public water recreation resources at present.

Pertinent data on the reservoir projects are shown in Table 1-3 and their location in Figure 1-15.

Local Protection Projects. There are five local protection levee systems in the water sub-region; located at Scranton, Swoyersville and Forty Fort, Wilkes-Barre-Hanover Township, Kingston-Edwardsville, and Plymouth, Pennsylvania. Pertinent data for these levee systems are shown in Table 1-4.

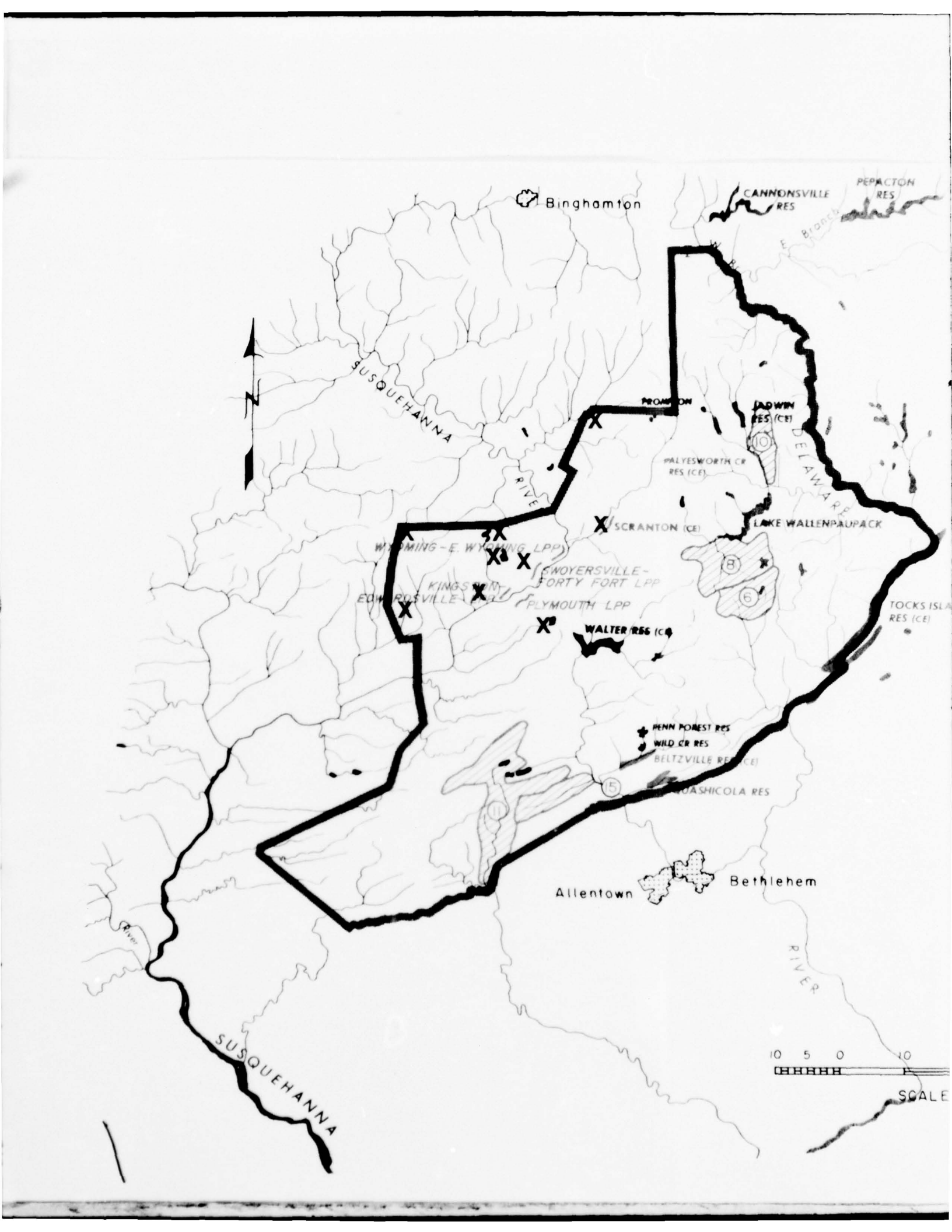
Studies Underway. In addition to the North Atlantic Regional Water Resources and the Northeastern United States Water Supply Framework Studies, there are four other federal studies underway in part of the water sub-region. Three are under the jurisdiction of the Corps of Engineers, Baltimore District Office. Briefly they are: (1) The Susquehanna River Basin Study to develop a comprehensive plan of development for the basin - this study began in 1963, and is scheduled for completion in June 1970; (2) the Miscellaneous Streams, Northeast Flood Control Study to develop recommendations for restoring levees and other flood control works damaged by mine subsidence - the draft of the report on this study has been completed and is now in the final review stages; (3) the Susquehanna River Basin Mine Drainage Study to consider all aspects of the acid mine drainage problem and make recommendations for the optimum plan for abatement - this study, which was authorized in response to a Senate Committee Resolution in April 1964, has not as yet been funded. The fourth is the Comprehensive Report on the Susquehanna River being accomplished by the Federal Water Pollution Control Administration under Section 3(a) of The Federal Water Pollution Control Act.

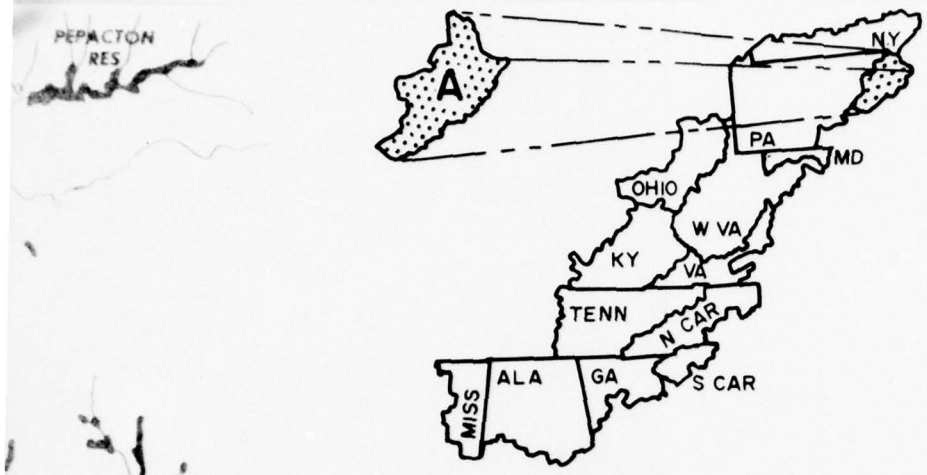
TABLE 1-3
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION A

ITEM	CORPS OF ENGINEERS								
	General Edgar Jadwin	Prompton	Francis E. Walter	Prompton (Modified)	Walter (Modified)	Aquashicola	Beltzville	Tocks Island	Lake Wallenpaupack*/
LOCATION									
Stream	Dyberry Cr. (Lackawaxen River)	Lackawaxen River	Lehigh R.	Lackawaxen River	Lehigh R.	Aquashicola Creek	Pohopoco Cr.	Delaware River	Wallenpaupack Creek (Lackawaxen River)
River Mile	2.5	31	81	31	81	4.5	4	82	1.5
County	Wayne	Wayne	Luzerne	Wayne	Luzerne	Carbon	Carbon	Pike	Wayne
STATUS	Existing	Existing	Existing	Authorized	Authorized	Authorized	Authorized	Author-ized	Existing
Authorized Purposes	FC	FC	FC	FC, WS, R	FC, WS, R	FC, WS, R	FC, WS, R	HD, FC, WS, R	HD
COMPLETION DATE	1960	1960	1961	After 1980	1989	1979	FY 1972	1978	1925
DRAINAGE AREA ABOVE (SQ. MI.)	65	60	288	60	288	66	96	3,827	228
ELEVATION (FT. MSL)									
Top of Upper Pool (FC/Power)	1,076.5	1,168	1,450	1,205	1,481	503	651	432	1,190
Top of Conservation Pool	--	1,125	1,300	1,180	1,425	483	628	413	(1,179) Summer (1,164) Winter
STORAGE ALLOCATED TO (ACRE FEET)									
Flood Control	24,500	20,300	108,000	20,300	108,000	20,000	27,030	383,400	**/
Power	--	--	--	--	--	--	--	--	158,000
Water Quality	--	--	--	--	--	--	--	--	--
Water Supply (M&I)	--	--	--	28,000	70,000	24,000	39,830	541,600	--
SURFACE AREA (ACRES)									
Top of Upper Pool (FC/Power)	855	630	1,840	910	2,600	1,130	1,410	17,200	5,760
Top of Conservation Pool	--	280	90	720	1,400	840	950	13,015	N/A
POWER INSTALLATION (HYDRO)									
Capacity (1000 KW)	--	--	--	--	--	--	--	46	40.0
Number of Units	--	--	--	--	--	--	--	2	2
YIELD (MGD)									
Water Supply	--	--	--	37	128	41	52	630	--
Water Quality	--	--	--	--	--	--	--	To be determined.	--
Low Flow Augmentation	--	--	--	57	196	63	(37 Jun-Aug) (24 Sep-Nov)	To be determined.	--

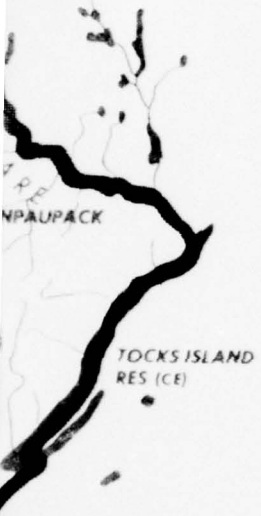
*/ Owned and operated by Pennsylvania Power and Light Company.

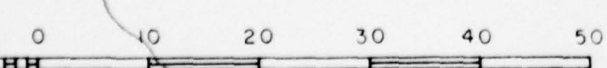
**/ Although flood control is not a project purpose, Wallenpaupack was operated in the interest of flood control during the record flood of August 19-21, 1955, which resulted in substantial reduction in damages in downstream reaches of Lackawaxen River.


Binghamton
CANNONSVILLE RES
PEPACTON RES
E. Branch
SUSQUEHANNA
RIVER
N
PROMPTON
LADWIN RES (CE)
PALYESWORTH CR RES (CE)
DELAWARE R.
SCRANTON (CE)
LAKE WALLENPAUPACK
WYOMING - E. WYOMING LPP
GIBBONS VILLE - FORTY FORT LPP
KINGSTON
PLYMOUTH LPP
WALTER RES (CE)
TOCKS ISLA RES (CE)
PENN FOREST RES
WILD CR RES
BELTZVILLE RES (CE)
BLOOMSBURG
Allentown
Bethlehem
RIVER
SUSQUEHANNA
10 5 0 10
SCALE



VICINITY MAP





SCALE IN MILES

UPSTREAM WATERSHED PROJECT

EXPECTED TO BE COMPLETED BY 1980

MAJOR RESERVOIR

COMPLETED

EXPECTED TO BE COMPLETED BY 1980

STATE RECREATION AND/OR FISHING LAKE:

X SURFACE AREA IN EXCESS OF 200 ACRES

LOCAL PROTECTION PROJECT

— EXPECTED TO BE COMPLETED BY 1980

REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA

WATER SUB - REGION A

WATER RESOURCES DEVELOPMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-1 35 FIGURE 1-15

TABLE 1-4

SUMMARY OF PERTINENT DATA
FEDERAL LOCAL PROTECTION PROJECTS, SUB-REGION "A"
LEVEE SYSTEMS

	PLYMOUTH, PA.	SCRANTON, PA.	Swoyersville AND FORTY FORT, PA.
STREAM:	Susquehanna River	Lackawanna River	Susquehanna River
COUNTY:	LUZERNE	LACKAWANNA	LUZERNE
DRAINAGE AREA (sq. mi.)	10,000	250	9,935
LEVEES:			
Length (ft.)	8,680	4,000	16,970
Top Width (ft.)	10	10	10
Average Height (ft.)			
SLOPE:			
Landside	1 on 2.5	1 on 2.5	1 on 3
Riverside	1 on 2.5	1 on 2.5	1 on 3
CONCRETE FLOOD WALLS:			
Length (ft.)	0	500	2,500
Average Height (ft.)			
PUMPING STATIONS - No.:			
Number of Pumps	2	1	0
Total Capacity (gpm)			
CHANNEL IMPROVEMENT (ft.):	2,670	9,000	3,900
YEAR COMPLETED:	1948	1969	1957

	WILKES-BARRE HANOVER TWP., PA.	KINGSTON EDWARDSVILLE, PA.
STREAM:	Susquehanna River	Susquehanna River and Toby Creek
COUNTY:	LUZERNE	LUZERNE
DRAINAGE AREA (sq. mi.)	9,978	9,995
LEVEES:		
Lenght (ft.)	27,860	22,530
Top Width (ft.)	10	10
Average Height (ft.)		
SLOPE:		
Landside	1 on 2.5	1 on 2.5
Riverside	1 on 2.5	1 on 2
CONCRETE FLOOD WALLS:		
Length (ft.)	160	0
Average Height (ft.)		
PUMPING STATIONS - No.:		
Number of Pumps	8	3
Total Capacity (gpm)		
CHANNEL IMPROVEMENT (ft.)	0	6,660*/
YEAR COMPLETED:	1948	1943

*/ 16.5 conduit through Edwardsville.

TABLE 1-4a
SUMMARY OF PERTINENT DATA
STATE AND LOCAL PROTECTION PROJECTS AND RESERVOIRS
SUB-REGION A

Community	County	Stream	Length (Feet)	Type	Yr. Completed
Delaware River Basin					
Hawley	Wayne	Lackawaxen River	8,000	Imp. Earth Channel	1963
			5,120	Levee	"
		Middle Creek	635	Conc. Channel	"
			2 (Ea)	Debris Dams	"
Honesdale	Wayne	Lackawaxen River	9,460	Imp. Earth Channel	1954
		Dyberry Creek	5,460	" " "	"
McAdoo	Schuylkill	Celebration Creek	6,500	Imp. Earth Channel	1967
Stroudsburg-East Stroudsburg	Monroe	Brodhead Creek	11,800	Imp. Earth Channel	1962
		McMichaels Creek	16,000	Levee	"
		Little Sambo Creek	560	Conc. Floodwall	"
			390	Conc. Ret. Wall	"
			2 (Ea)	Ponding Areas	"
Weissport Twn.	Carbon	Lehigh River	2,600	Levee	1960
		" "	900	Raising Levee	"
White Mills	Wayne	Lollipole Creek	287	Conc. Channel	1962
				Settling Basin	"
				Debris Dam	"
Susquehanna River Basin					
Mayfield and					
Olyphant	Lackawanna	Lackawanna River	26,000	Imp. Earth Channel	1956
Blakely	"	" "	9,000	Spoil Dikes	"
Throop and Dickson City	"	" "	5 (Ea)	Drainage Structures	"
Mayfield	"	" "	Small	Add. to Exist. Levee	-
Dickson City	"	Old Dam Creek	545	Channel Relocation	1960
Scranton	"	Lackowanna River	2,800	Deepen and Widen	1960
Scranton	"	Roaring Brook	2,600	Rein. Conc. Culvert	1961
Scranton	"	" "	1,925	Widen, Deepen, and Realign	1958
Scranton	"	Stafford & Meadow Brook	1,365	Rein. Conc. Channel	1965
Moosic	"	Lackawanna River and	2,700	Levee	1963
		Spring Run	650	Levee	1963
Moosic	"	Spring Brook	4,900	Levee	-
			2,600	Conc. Channel	
			850	Channel Realign. and Debris Basin	
Durvea	Luzerne	Lackawanna River	4,500	Levee	1967
Wyoming	Luzerne	Abrahams Creek	4,800	Channel Ex. & Realign.	1959
Plymouth	Luzerne	Wadham Creek	-	Debris Dam	
Plymouth	Luzerne	Duffy Run	1,800	60" Dia. Conc. Culvert	1961
Plymouth	Luzerne	Brown Creek	1,800	Debris Basin & 10' Dia. Conc. Culvert	1959
Plymouth	Luzerne	Duffy Run	-	Debris Dam	1965
Nacanahua	Luzerne	Lackawanna River	4,500	Levee	1967

DAMS AND RESERVOIRS

Susquehanna River Basin

Name	County	Stream	Surface Area in Acres	Yr. Complete
Tunkhannock Dam	Lackawanna	Tunkhannock Creek	202	-
Francis Slocum Dam	Luzerne	Abrahams Creek	155	1963
Lake Jean	Luzerne	Kitchen Creek	245	1951
Lake Scranton	Lackawanna	Stafford Meadow Brook	225	-
Pike Creek Dam	Luzerne	Pike Creek	400	-
Huntsville Stor. Dam	Luzerne	Huntsville Creek	390	-
Crystal Lake	Luzerne	Wapwallopen Creek	494	-
Lake Pinecrest	Luzerne	Trib. Pine Creek	880	-
Harvey's Lake	Luzerne	Harvey's Creek	659	-

U.S. Department of Agriculture

Land use, treatment and management programs of various Department of Agriculture agencies are contributing significantly to water quality improvement. These programs are designed to reduce erosion and sediment. Basic conservation plans are being put into effect for 357,000 acres in the water sub-region by over 2,267 landowners and operators cooperating with their local soil and water conservation districts.

To date, 653,900 acres, or 27 percent of the land in the water sub-region have been adequately treated through the application and installation of conservation practices needed to meet its planned use, improvement, and protection. Technical assistance is available through cooperative State and Federal programs to forest land owners.

The Farmers Home Administration of the U.S. Department of Agriculture has received applications for water and sewage comprehensive planning grants. Applications have also been received for loans and grants to improve, enlarge, or construct sewer systems, waste treatment plants, and storm drains.

There are 386 privately-owned ponds in the water sub-region that provide an additional 4,930 acre-feet to meet individual needs. Five USDA upstream watershed projects with 32 structures are being installed in Water Sub-region A. Three other structures have been planned. Pertinent data for the five upstream watershed projects are given in Table 1-5. Locations are shown in Figure 1-15. For additional data on USDA programs, see Appendix A - Agriculture, Forestry and Conservation.

Water Resources Development - Non-Federal

Pennsylvania Power and Light Company

There is one major hydro-power reservoir, Lake Wallenpaupack, within Sub-region A. The reservoir, which is located in eastern Wayne County, is owned and operated by Pennsylvania Power and Light Company. The installation, which has a capacity of 40.0 megawatts, contributes to the Pennsylvania-New Jersey-Maryland Interconnected System which serves all of Sub-region A. Pertinent data for the reservoir is shown in Table 1-3 and its location depicted in Figure 1-15.

State and Local Protection Projects and Reservoirs

Table 1-4a lists the state and local protection projects in Sub-region A as well as the non-Federal reservoirs over 200 acres in surface area.

TABLE 1-5

SUMMARY OF PERTINENT DATA
UPSTREAM WATERSHED PROJECTS, SUB-REGION A*/

Map Reference Number (Figure 9-10)	Name of Watershed	Status	Drainage Area of Waterhead	Drainage Area Regulated (Sq. mi.)	Number of Structures		Storage Volume by Purpose (Acre Feet)			
					Flood Retention	Multi-purpose	Flood Water	Recreation	M&I Water Supply	Other**/
6	Broadhead Creek	authorized	29.10	18.75	3	1	4,107	60	-	308
8	Green-Dreher Tribs.	authorized	74.70	30.71	16	-	6,946	-	-	311
10	Lackawaxen Tribs.	authorized	41.60	5.43	7	-	1,112	-	-	81
11	Little Schuylkill River	authorized	135.70	35.13	3	1	8,694	-	-	2,334
15	Mauch Chunk Creek	authorized	9.05	5.95	-	1	1,094	3,794	375	61
	TOTAL		290.15	95.97	29	3	21,953	3,854	375	3,095

*/ Includes only those projects that have been completed or authorized.

**/ Includes Sediment and Fish and Wildlife.

Commonwealth of Pennsylvania Mine Drainage Abatement Program

The Ten Year Mine Drainage Abatement Program of the Commonwealth of Pennsylvania is currently underway. Counties within Water Sub-region A that are affected by this program are Lackawanna, Schuylkill, Luzerne and Carbon.

The target completion date for the $150 million program is 1975. Program purposes focus on acid mine drainage pollution abatement through the following measures: (a) mine sealing; (b) burial of acid-forming refuse; (c) correction of defective backfills; (d) diversion of streams; (e) regulation of stream flows; and (f) water treatment efforts.

Municipal

In 1964, Water Sub-region A was served by 74 public or privately-owned water companies (see Table 1-6). Average consumption in the water sub-region in terms of quantity of water sold during that year was about 98 million gallons per day (MGD).

TABLE 1-6

MUNICIPAL WATER FACILITIES - CITIES EXCEEDING 5,000 POPULATION

County/City	Est. Pop. Served (1960)	Source of Supply	Rated Plant Cap. MGD	Average Plant Output MGD
LACKAWANNA				
Archbald	5,471	Scranton		
Blakley	6,374	Scranton		
Dickson City	7,738	Scranton		
Carbondale	13,595	Scranton		
Dunmore	18,917	Scranton		
Old Forge	8,928	Scranton		
Olyphant	5,864	Scranton		
Scranton	111,443	Penn Gas & Water Co., Surface: (Private)	NA	29.5
Taylor	6,148	Scranton		
Winton	5,456	Scranton		
LUZERNE				
Duryea	5,626	Wilkes-Barre		
Edwardsville	5,711	Wilkes-Barre		
Forty Fort	6,431	Wilkes-Barre		

TABLE 1-6 - Continued

County/City	Est. Pop. Served	Source of Supply	Rated Plant Cap. MGD	Average Plant Output MGD
LUZERNE (cont'd)				
Freeland	5,068	Freeland Water Authority, Underground: (Public)	NA	0.3
Hazleton	32,056	Hazleton Water Authority, Surf. & Underground: (Public)	8.8	5.0
Kingston	20,261	Wilkes-Barre		
Nanticoke	15,601	Wilkes-Barre		
Pittston	12,407	Wilkes-Barre		
Plymouth	10,401	Wilkes-Barre		
Swoyersville	6,751	Wilkes-Barre		
West Hazleton	6,278	Hazleton		
West Pittston	6,998	Wilkes-Barre		
Wilkes-Barre	67,870	Penn Gas & Water Co., Surface: (Private)	5.8	NA
SCHUYLKILL				
Ashland	5,237	Ashland Boro Water Co., Surf. & Underground: (Public)	NA	0.7
Frackville	5,654	Mt. City Water Co., Underground: (Private)	1.1	0.6
Mahanoy City	8,536	Mahanoy Water Auth., Surface: (Public)		1.5
Pottsville	21,659	Pottsville Water Auth., Surface: (Public)	7.5	5.0
St. Clair	5,159	Pottsville		
Schuylkill Haven	6,470	Schuylkill Haven Water Auth., Surface: (Public)	3.0	1.3
Shenandoah	11,073	Shenandoah Water Auth., Surface: (Public)	3.0	2.5

TABLE 1-6 - Continued

County/City	Est. Pop. Served	Source of Supply	Rated Plant Cap. MGD	Average Plant Output MGD
SCHUYLKILL (cont'd)				
Tamaqua	10,173	Tamaqua Water Auth., Surface: (Public)	NA	1.5
CARBON				
Jim Thorpe	5,945	Jim Thorpe Water Auth., Surf. & Underground: (Public)	0.8	0.6
Lansford	5,958	Lansford Water Auth., Surf. & Underground: (Public)	NA	0.6
Lehighton	6,318	Lehighton Water Auth., Surface: (Public)	NA	1.0
Palmerton	5,942	Palmer Water Co., Underground: (Private)		0.4
MONROE				
Stroudsburg	6,070	Stroudsburg Water Auth., Surf. & Underground: (Public)	4.0	1.0
E. Stroudsburg	7,674	E. Stroudsburg Water Auth., Surface: (Public)	NA	2.0
PIKE	(None Over 5,000 Population)			
WAYNE	(None Over 5,000 Population)			

SOURCE: Bureau of Census, City and County Data Book, 1962
Inventory of Selected Public Service Facilities in Appalachia, Water Supply Facilities, Vol. III, prepared for Appalachian Regional Commission by Brunswick Corporation.

As shown in Table 1-7, 1964 water use was concentrated in the Anthracite Counties of the water sub-region.

TABLE 1-7

SUMMARY OF WATER SUPPLIED BY UTILITIES COMPANIES: 1964
WATER SUB-REGION A

Location	1960 Population (1,000)	Number Water Companies	Total Water Sold (MG)	Average Output (MGD)
Anthracite Counties	754	45	27,250	75
Lackawanna				
Luzerne				
Schuylkill				
Pocono Counties	130	29	8,260	23
Carbon				
Monroe				
Pike				
Wayne				
Water Sub-region A Total	884	74	35,510	98

SOURCE: Pennsylvania Statistical Abstract, 1966

SECTION II - SOCIO-ECONOMIC STRUCTURE

4. INTRODUCTION

Planning Devices

Appalachia has been divided into 10 water sub-regions, labeled "A" through "J," with their boundaries established so as to correspond as nearly as possible to physical areas created by drainage basins, and to areas of responsibility of various participating Corps of Engineer Districts and the Tennessee Valley Authority. In delineating the water sub-region boundaries, adjustments were made to accomodate the state planning sub-regions. Figure 1-16 shows the different planning areas located in or related to Water Sub-region A.

The Office of Business Economics has regionalized Appalachian counties into a series of twenty-seven economic sub-regions focused on trade centers. Projections made on the basis of OBE economic sub-regions have been adapted to the 10 water sub-regions, and on a very limited basis to the 63 state planning sub-regions. (See Appendix E.) All seven counties of Water Sub-region A are in Economic Sub-region 3, which additionally includes Columbia, Sullivan and Wyoming Counties in Water Sub-region B. The trade and service center of Economic Sub-region 3 consists of the Wilkes-Barre - Hazleton; and the Scranton Standard Metropolitan Statistical Areas (SMSAs). The Wilkes-Barre - Hazleton SMSA is Luzerne County; the Scranton SMSA is Lackawanna County. These two SMSAs provide the center around which an economic region can be defined. The remaining five counties compose the hinterlands of this center.

Sixty-three state Planning sub-regions, focused on urban growth centers, have been established by the Appalachian States to implement planning and administer programs on the local level. Each state planning sub-region is wholly contained within one state. The states have used various criteria in arriving at these state planning sub-areas. Some of them are closely related to physiographic factors, while others are based more nearly on trade flows and related economic characteristics. The wide differences between states in delineation methods may restrict the use of these areas for planning purposes, but this limitation has, to some extent, been overcome by use of economic sub-regions and identifying growth centers of a variety of types and sizes.

Within each of the state planning sub-regions, the states, as part of their Appalachian development plans, have designated one or more areas as having significant potential for future growth (growth areas). Such areas have been defined by the Appalachian Regional Commission as:

> ....An area consisting of an urban center or centers and their hinterland where the state has determined significant future growth is likely or can be induced.
>
> By a center or centers is meant a complex consisting of one or more communities or places which, taken together, provide or are likely to provide a range of cultural, social, employment, trade, and service functions for itself and its associated rural hinterlands. Though a center may not be fully developed to provide all these functions, it should provide, or potentially provide, some elements of each, and presently provide a sufficient range and magnitude of these functions to be readily identifiable as the logical location for many specialized services to people in the surrounding hinterland.

Of the seven state planning sub-regions in Pennsylvania, State Planning Sub-region 10 is coterminous with Water Sub-region A.

Growth centers have been identified for the state planning sub-region. In the Anthracite Counties, these are Scranton, in Lackawanna County; Wilkes-Barre and Hazleton, in Luzerne County; and, Pottsville, in Schuylkill County.

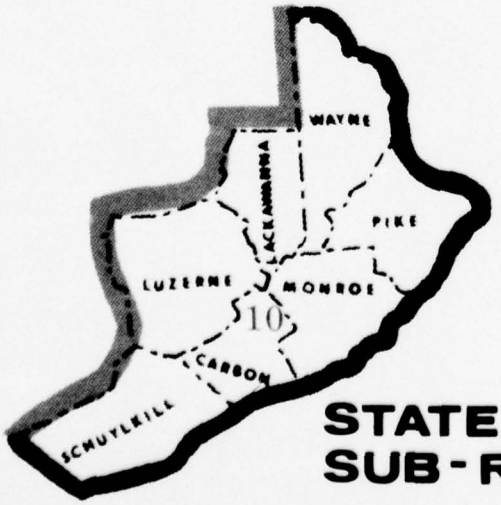
The Poconos Counties form a growth area composed of the minor centers of Stroudsburg and East Stroudsburg, in Monroe County; Lehighton and Jim Thorpe, in Carbon County; Honesdale, in Wayne County; and, Milford, in Pike County. They are expected to provide the cultural, social, service and trade centers necessary to support population growth and expansion of the recreation service industry throughout the Poconos recreation area.

Growth centers are emphasized in this chapter; however, it should be noted that not all projects for water resources development will be located at these centers. There are some areas, not now recognized as growth centers, which may have developmental potential with a water resource project. Also, some projects serve wide regional interests and thus are not strictly related to local Appalachian growth centers. Examples are found in a hydroelectric power project or a major upstream development that would provide flood control, water supply or water quality control for a downstream urban area outside of Appalachia.

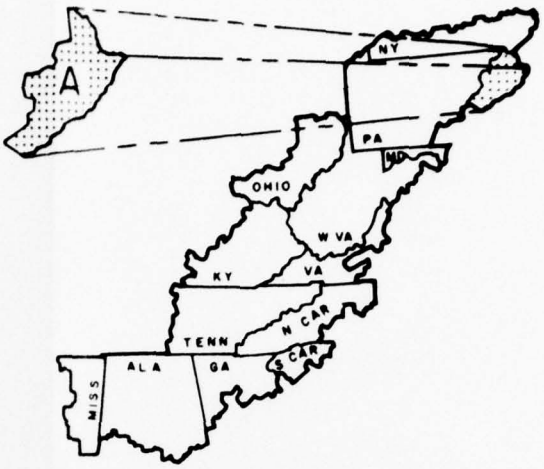
Economic Characteristics

Population loss during the 1940-1960 period resulted largely from population out-migration. Though net out-migration continued between 1960 and 1965, it was not sufficient to cause a decline in total population during this latter period.

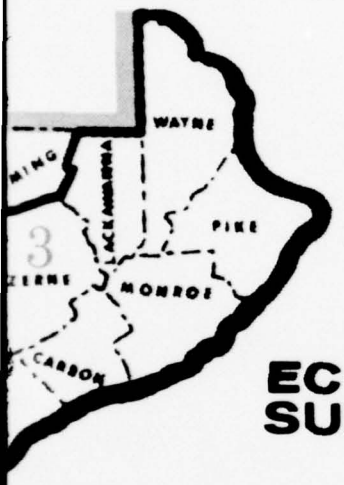
ECONOM
SUB-REG



STATE PLANNING
SUB-REGION



VICINITY MAP



ECONOMIC SUB-REGION

APPALACHIAN REGIONAL BOUNDARY

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION A

PLANNING AREAS

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-1-47 FIGURE 1-16

Approximately 41 percent of total employment in Water Sub-region A (1960) is in manufacturing. A little under 2 percent of total 1960 employment is in agriculture. In 1966, agriculture accounted for less than 1 percent of the private non-farm wage and salary income of employed persons in the water sub-region.

The 1964 agricultural census figures for Water Sub-region A (Figure 1-17) show that livestock and livestock products were the leading agricultural products in terms of value. The value of such products amounted to $35 million, while the value of all crops amounted to almost $44 million. The bulk of livestock products consisted of dairy products.

Despite a marked increase in farm product sales over the period 1949-1964, the agricultural industry in the water sub-region is doing little more than holding its own. This is especially true in the case of crops.

Forest land comprises over two-thirds of the 2.8 million acres of land in the water sub-region. About 97 percent of the forest land is classified as commercial (see Appendix A, particularly Tables I, VIII, IX, and X for more details).

In 1962, the volume of timber products output was 12 million cubic feet of sawlogs, veneer logs, and miscellaneous products; 1 million cubic feet of pulpwood; and 3 million cubic feet of fuelwood. The total estimated value of the output was about $4.5 million. Sawlogs and veneer logs accounted for more than 75 percent of the total value.

Estimated 1962 employment in timber-based manufacturing industries was 1,768, less than .05 percent of total employment. About 50 percent were employed in the lumber and wood products industry. The balance were employed in the pulp, paper and allied products industry. Employment is expected to increase to about 1,873 by 1980. From 1980, however, employment is expected to gradually decrease to about 1,437 in 2020. Highest employment levels are expected in the pulp, paper and allied products industry.

The timber inventory of growing stock for all species will continue to increase so long as net annual growth exceeds cut. This inventory is expected to grow from 1,727 million cubic feet in 1962 to 2,919 million cubic feet in 2020.

In 1965, anthracite accounted for $111 million of the $118 million total value of mineral production in the water sub-region. The remainder is mainly construction minerals such as stone, aggregate, gravel, and sand that are mostly consumed within the region.

Employment in anthracite mining has been declining for several decades, and there is no discernible development to arrest this trend. It is likely that the growth in demand for construction minerals can partially counteract the continued decline in anthracite production. While mining accounted for just under 5 percent of employment in 1960, the overall outlook for this sector is for continued decline in economic importance.

As traditional sources of employment and income in the water sub-region such as mining and agriculture continue to decline in importance, development of manufacturing and associated service industries is taking up some of the slack in the labor force. With over 40 percent of the water sub-region's employed labor force engaged in manufacturing activities, manufacturing employment exceeds the national average of about 25 percent.

In 1966, manufacturing accounted for over 38 percent of the water sub-region's wage and salary income. The largest portion of increased manufacturing employment is in the textiles, apparel, tobacco, and leather goods industries. These industries provide employment for a high percentage of the female labor force in the water sub-region.

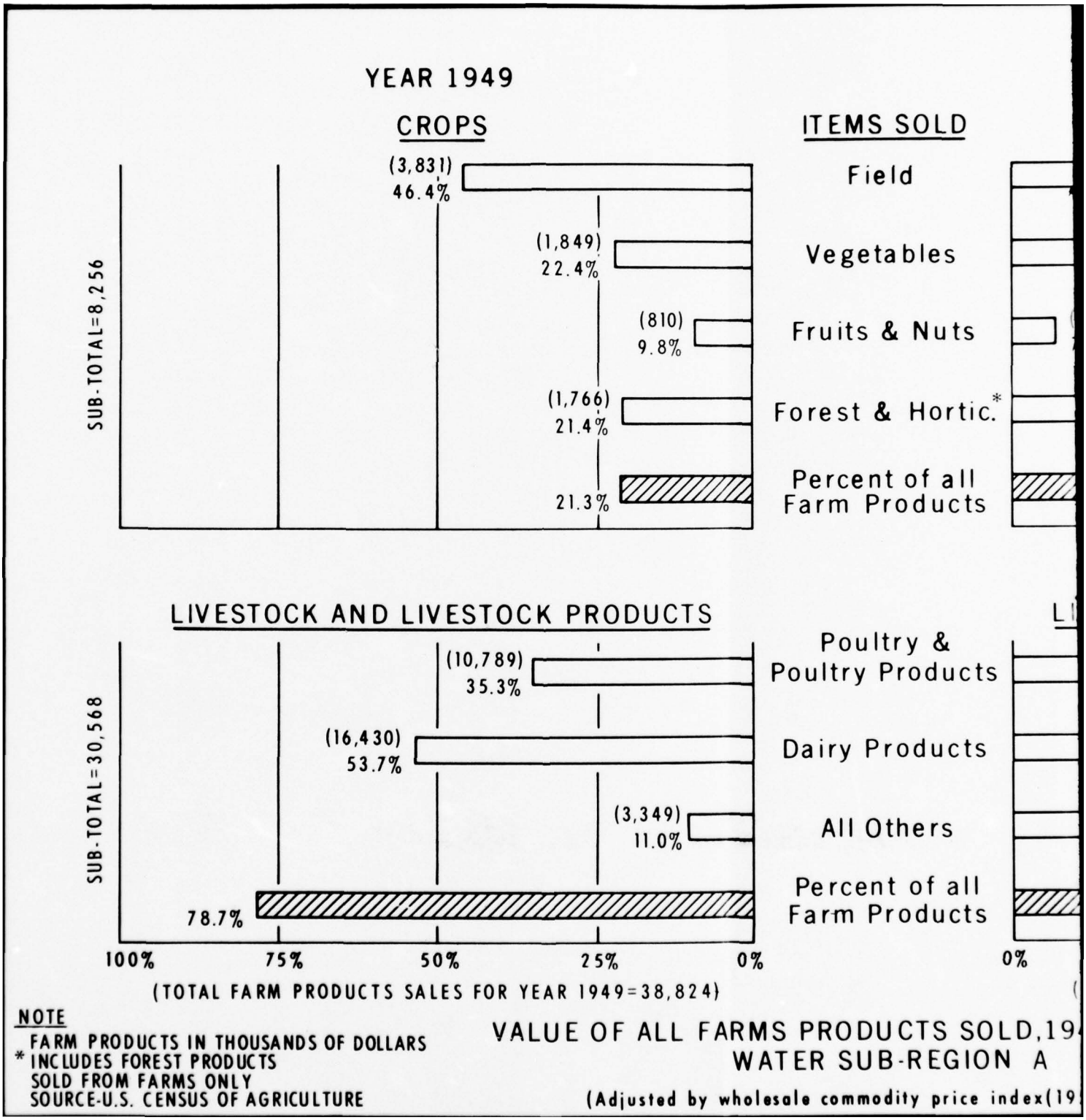
Wholesale and retail trade accounted for over 14 percent of the water sub-region's employment in 1960, and 17 percent of the wage and salary income in the private non-farm sector.

Water Sub-region A has not developed a mature service sector. This is largely reflected in lower income levels and the prevalence of a large rural population. In 1960, service activities employed 34.1 percent of the labor force nationwide, while only about 16 percent of those in Water Sub-region A were so employed.

Slightly over 4 percent of 1960 employment in the water sub-region was in the government sector. This figure falls short of the 13 percent figure for the nation in 1960.

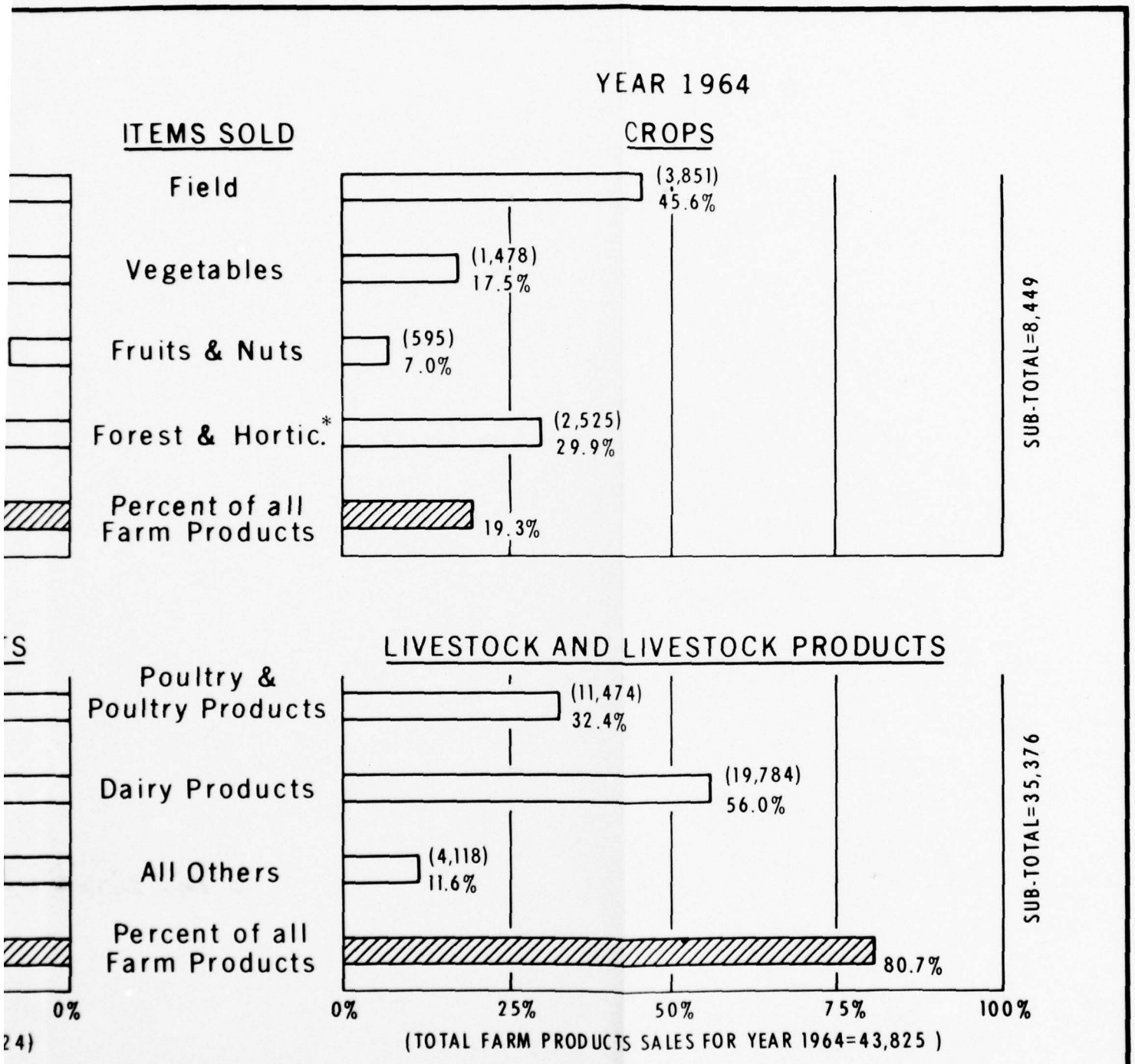
The water sub-region's most depressed point in terms of a high unemployment rate was in 1958. Since then, the picture has been improving. As the unemployment rate has declined, population out-migration has been lessened and since 1964 the labor force has increased. This does not mean that out-migration has stopped; rather, it has slowed to the point where it is less than the national increase in the labor-force age group.

Problems caused by unemployment have been as severe in the water sub-region as anywhere else in the Appalachian Region. Declining employment and its resulting erosion of the tax base has severely limited the ability of local governments to respond to, or allevaite, community problems.



NOTE
FARM PRODUCTS IN THOUSANDS OF DOLLARS
* INCLUDES FOREST PRODUCTS SOLD FROM FARMS ONLY
SOURCE-U.S. CENSUS OF AGRICULTURE

VALUE OF ALL FARMS PRODUCTS SOLD, 19
WATER SUB-REGION A
(Adjusted by wholesale commodity price index(19



FARMS PRODUCTS SOLD, 1949 AND 1964
WATER SUB-REGION A

by wholesale commodity price index(1957-59=100)

FIGURE 1-17

Estimates of employment disguise the extent of current unemployment in the water sub-region. For example, some of the labor force are gainfully employed only seasonally. Yet these people are considered statistically as working around the year. The 1966 national unemployment figure of 5.1 percent is greater than all counties in the water sub-region with the exception of Schuylkill County which suffers from an employment rate of 5.7 percent. Figures for the counties in the water sub-region are shown on Figure 1-18.

In 1960, almost 23 percent of the families in Water Sub-region A earned less than $3,000 per year. Nationally, this figure amounted to approximately 22 percent. A comparison of family money income between the water sub-region and the United States for 1960 is shown in Figure 1-19.

Per-capita personal income for the water sub-region in 1960 was $1,685; for the United States, $2,215. A comparison of sources of earnings by employment sector is presented in Figure 1-20.

Capital Availability

In most instances, funds required to conduct studies for economic development of the water sub-region and to implement their recommendations are furnished jointly by federal, state and local governments.

Federal participation is involved in providing a part of the planning and construction costs of justified public improvement projects. This participation is authorized under a variety of legislative programs administered by the Departments of: Defense; Agriculture; Interior; Housing and Urban Development; Commerce; and Health, Education and Welfare. Local or state governments contribute a percentage of planning and construction funds, as well as all real estate acquisition and project maintenance costs for federal participation programs. Urban planning funds spent by federal, state and local agencies in Water Sub-region A from 1956-1964 are shown in Figure 1-21.

There are a number of Pennsylvania state-aid programs for the purposes described above. The two state programs which are most relevant to water resources development are Project 70 and the recent Land and Water Conservation and Reclamation Act (Project 500). The former provides funds for acquisition of conservation and recreation areas.

Project 500 has authorized $200 million to the Department of Mines and Mineral Industries, with $150 million to be used for mine drainage and strip mine reclamation, $25 million for burning culm piles, and $25 million for mine subsidence and mine fires. A total of $100 million has been authorized to the Health Department for sewage treatment plant construction grants and $200 million for recreation purposes.

The Pennsylvania Bureau of Industrial Development, Department of Commerce, and many local and regional industrial and tourist development groups are concerned with economic development programs.

Private and quasi-private financial institutions are in existence in the water sub-region (see Figure 1-22) to provide for the necessary inflow of savings to meet investment opportunities.

In comparison of 1960 census data concerning both Bank and Savings and Loan Association total deposits per capita indicates that these deposits in Water Sub-region A amounted to about $1,100 per capita. This was 80 percent of the national average of $1,400.

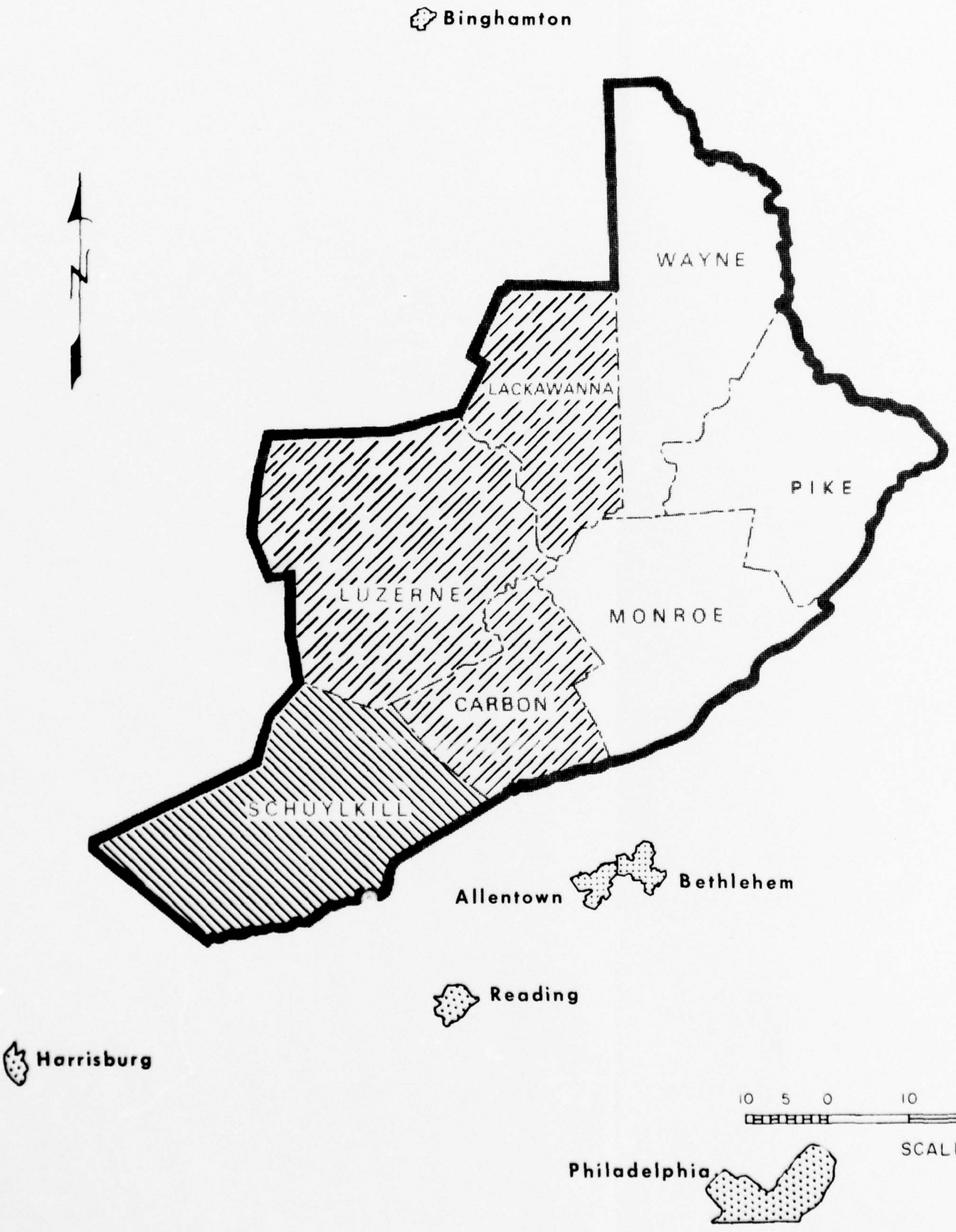
Total time deposits held by commercial banks in Water Sub-region A was $700 per capita. This is about 130 percent of the national average of $550. Consequently, it would appear that local banks have good capability for providing venture capital for suitably secured private investment.

Local Attitudes

Despite the complexity and magnitude of their economic and environmental problems, the people of the water sub-region are not characterized by pessimism and despair. To the contrary; a positive attitude towards economic development exists in the region, particularly in the Anthracite Counties.

Throughout most of the water sub-region, many county and municipal planning agencies, as well as local development authorities, are active. Water resources planning by such agencies as the Soil Conservation Service, the Pennsylvania Department of Forests and Waters, and the Corps of Engineers receive widespread interest and enthusiastic support.

Past economic trends have contributed to the general interest in growth policies. In the past, the water sub-region relied almost



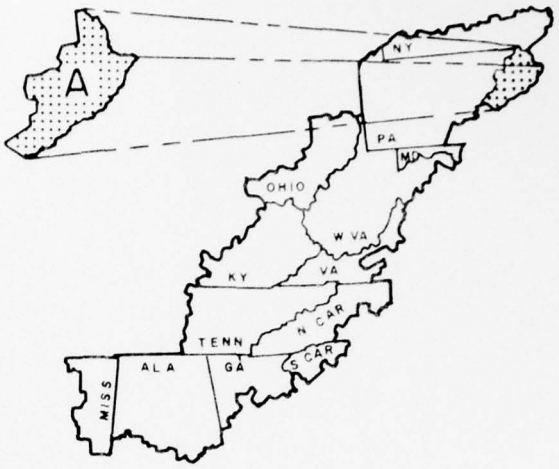
NO

VALUES SH

1. PERCEN
LABOR

2. FOR 19

New Yo



VICINITY MAP

LEGEND

	COUNTIES HAVING LESS THAN 3.0%
	COUNTIES HAVING 3.0% – 4.9%
	COUNTIES HAVING 5.0% – 6.4%
4.7%	WATER SUB–REGION A TOTAL

PIKE

em

New York City

NOTE

VALUES SHOWN ARE:

1. PERCENTAGE OF CIVILIAN LABOR FORCE
2. FOR 1966

5 0 10 20 30 40 50

SCALE IN MILES

REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA

WATER SUB - REGION A

UNEMPLOYMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-1-55 FIGURE 1-18

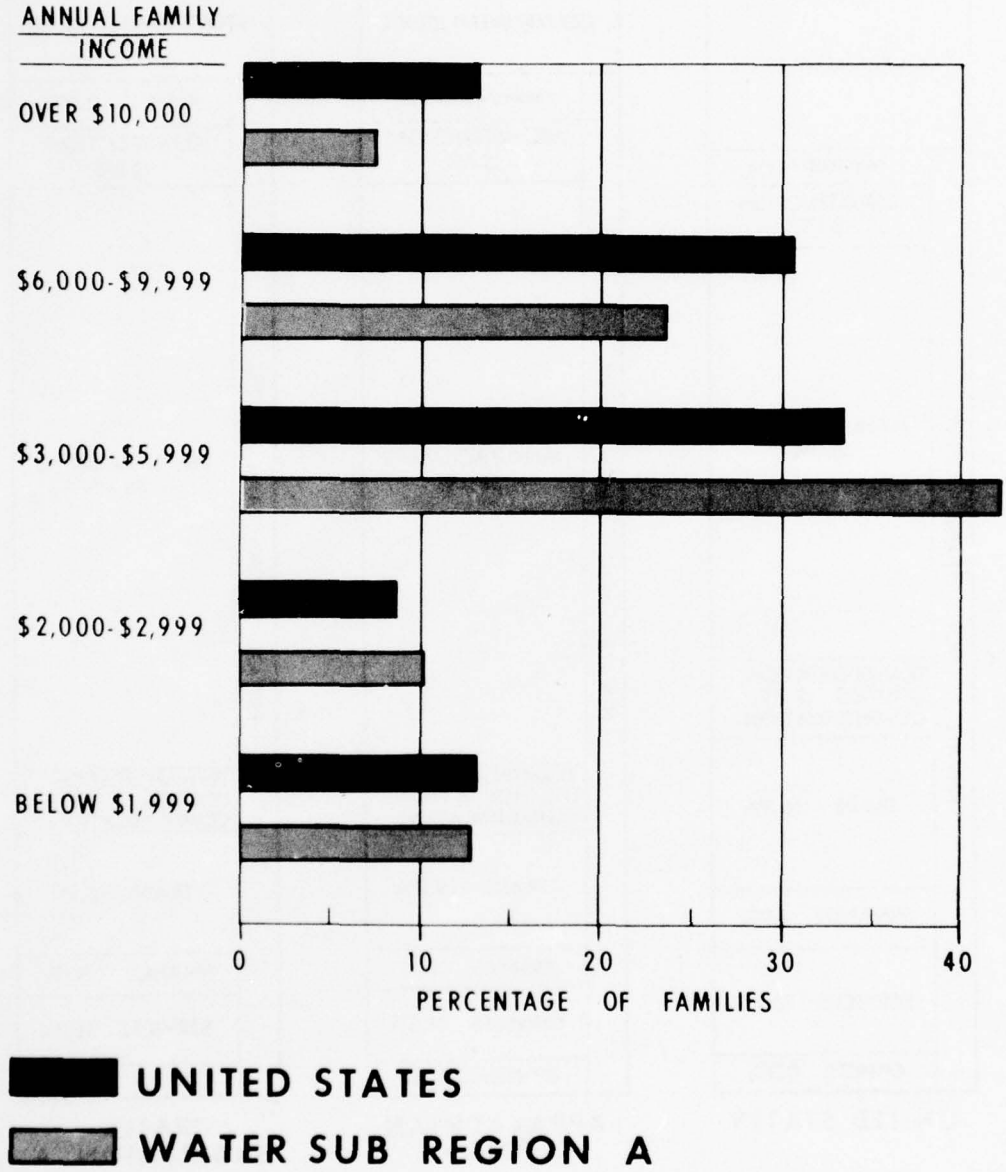


FIGURE 1-19 FAMILY INCOME 1960

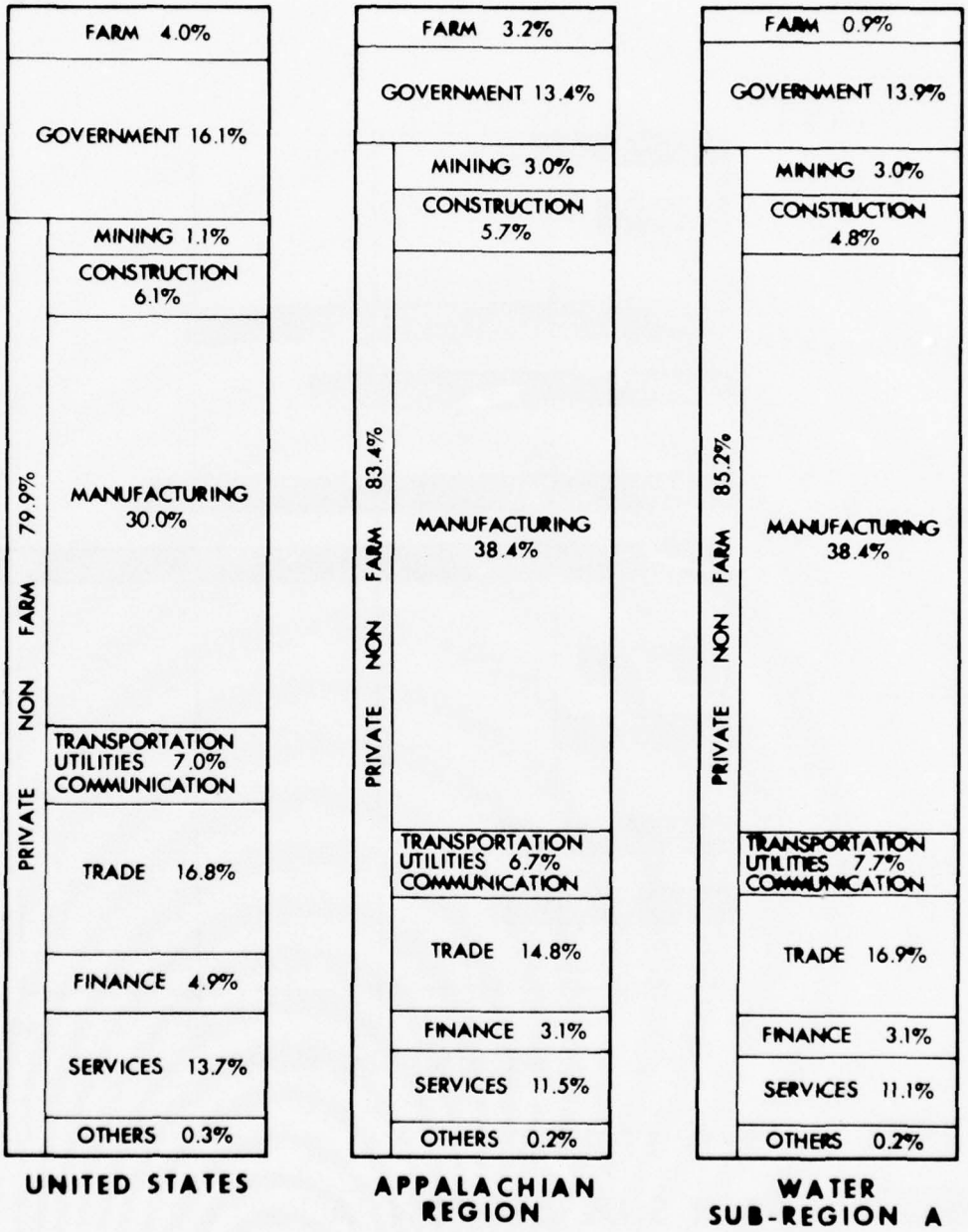


FIGURE 1-20 SOURCES OF INCOME

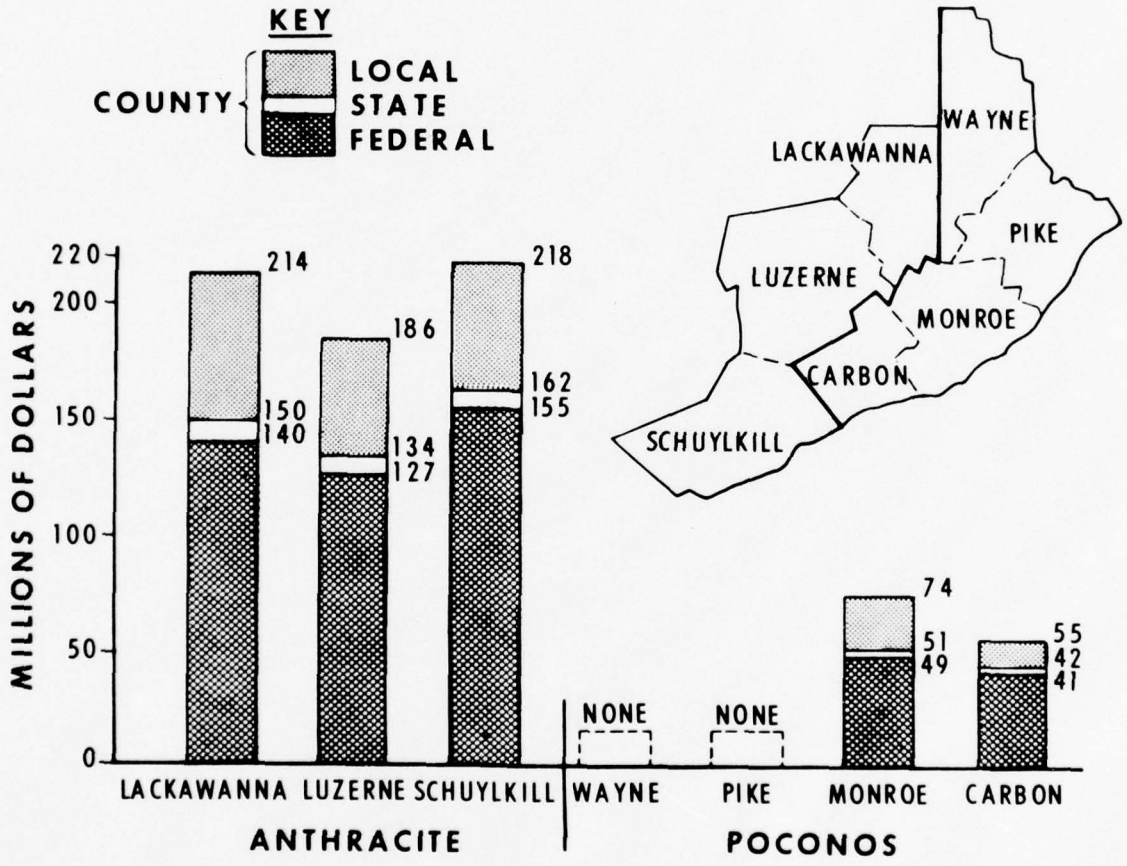
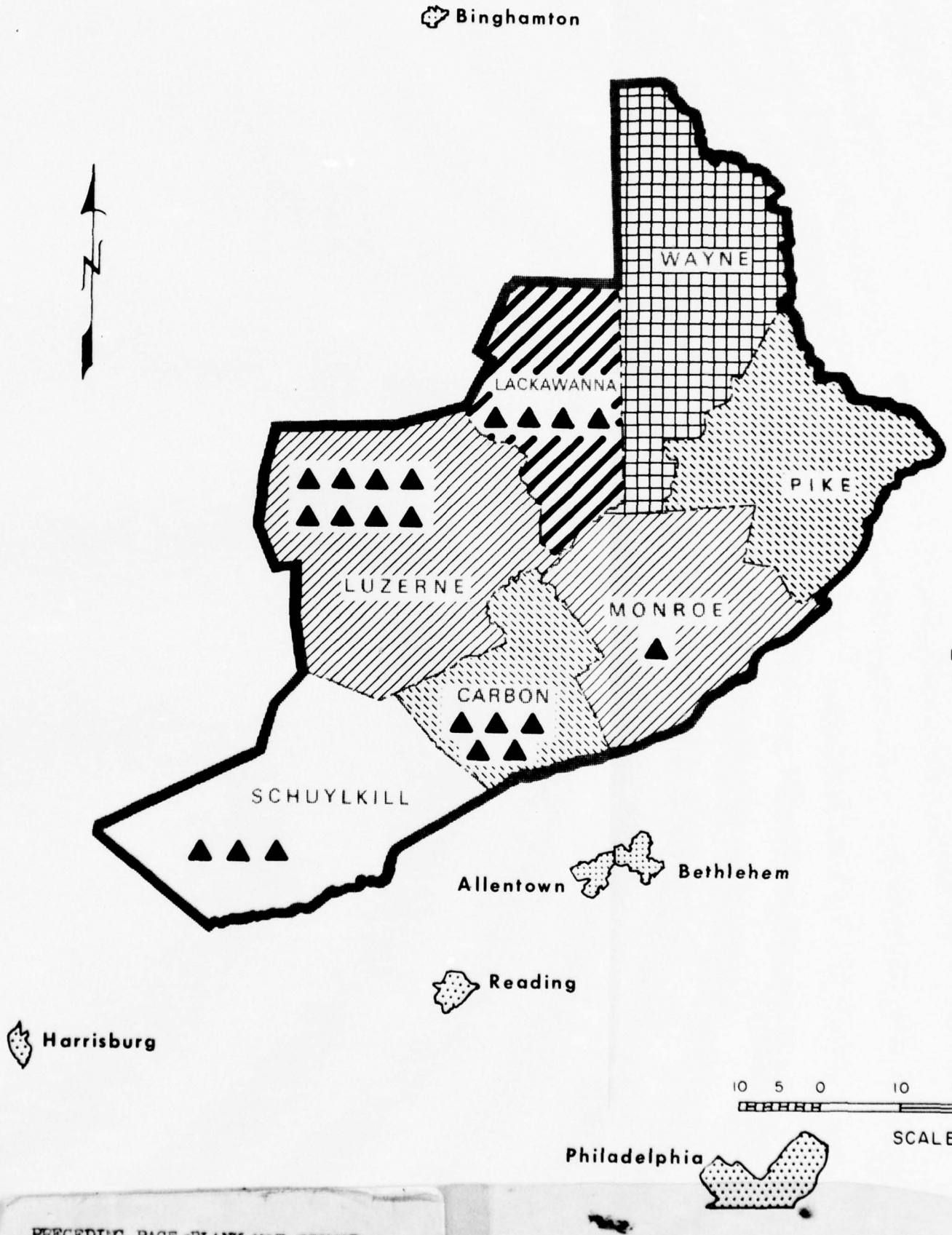
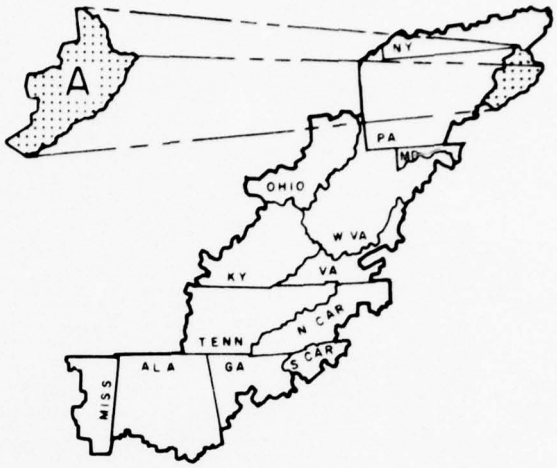


Figure 1-21 - Urban Planning Funds Expended by Federal, State and Local Agencies in Sub-region "A" - by County - 1956 Through 1964.



PRECEDING PAGE BLANK-NOT FILMED



VICINITY MAP

LEGEND

SAVINGS & LOAN ASSOCIATIONS

BANK DEPOSITS PER-CAPITA BY COUNTY:

- LESS THAN $1300
- $1300 – $1499
- $1500 – $1799
- $1800 – $1999
- $2000 OR MORE

KE

NOTE

PER-CAPITA DEPOSITS AS OF 30 DECEMBER 1967

New York City

0 10 20 30 40 50

SCALE IN MILES

REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA

WATER SUB-REGION A

FINANCIAL SITUATION

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-1-61 FIGURE 1-22

exclusively on anthracite mining. This lack of diversity in the employment mix intensified adjustment problems after anthracite's demise. At the same time, declines have occurred in agricultural employment. This partially reflects gains in agricultural productivity, increased size of farming units, and shifts to dairy farming.

While industry has located in the area, it has been generally of the low-wage variety. Such expansion tends to create conflicts between diverse interest groups when development strategy is examined; for example, the desire for higher wage rates associated with large manufacturing firms must be compared with a need for diversification in the economic mix. In recent years there has been a growth in durable goods manufacturing employment.

Water Sub-region A's impediments to economic development are resolvable by a concentration of effort by local, state and federal agencies. If funding problems can be solved, many of the ravages left by mining activities are correctable because they are primarily physical in nature. A second problem is a shortage of skilled labor, a possibly more difficult problem because it involves people, their attitudes and educational aspirations.

The Poconos Counties of Water Sub-region A should concentrate on satisfying recreation demand and its attendant requirements. Provision of goods and services required by the recreation industry will provide part of the economic base to improve the area.

The Anthracite Counties, now becoming an industrial area, should continue to concentrate on attracting manufacturing industries. Concurrent with this effort should be action on reclamation of mine-scarred land, elimination of mine fires, correction of mine and drainage problems, increase efficiency of mining operations, and renewal of the area's towns.

Select socio-economic indicators for Water Sub-region A (State Planning Sub-region 10) are shown in Tables 1-8 and 1-9.

5. GROWTH AREAS

Individual states, in cooperation with the Appalachian Regional Commission, have designated, as part of their respective Appalachian Development Plans, certain areas as "Growth Areas." In Water Sub-region A, five such areas, or area groupings, are considered to have growth potential. These are listed on the basis of potential as: (a) Scranton-Wilkes-Barre-Hazleton; (b) Pottsville; (c) Stroudsburg-East Stroudsburg; (d) Lehighton-Jim Thorpe; and (e) Honesdale.

Group (a) above is identified as a regional growth center by the Appalachian Regional Commission. Groups (b) and (c) are designated as primary growth centers; Groups (d) and (e) as secondary growth

TABLE 1-8

EMPLOYMENT BY SECTOR FOR 1950 AND 1960

PENNSYLVANIA STATE PLANNING SUB-REGION 10

	1950	1960	Absolute Change
TOTAL ALL SECTORS	351,859	313,602	-38,257
PRIMARY ACTIVITIES	79,460	21,587	-57,873
Agriculture	11,040	6,922	- 4,118
Forestry & Fisheries	190	117	- 73
Mining	68,230	14,548	-53,682
SECONDARY ACTIVITIES	113,902	129,028	15,126
Contract Construction	15,529	14,529	- 1,000
Food & Kindred Products	7,435	8,313	878
Textile Mill Products	16,185	9,562	- 6,623
Apparel	36,286	38,970	2,684
Lumber, Wood Products, Furniture	2,458	2,736	278
Printing & Publishing	4,128	5,977	1,849
Chemicals & Allied Products	2,095	2,452	357
Electrical & Other Machinery	6,505	13,074	6,569
Motor Vehicles & Equipment	369	1,942	1,573
Other Transportation Equipt.	465	1,758	1,293
Other & Miscellaneous	22,447	29,715	7,268
TERTIARY ACTIVITIES	153,934	148,073	- 5,861
Transportation & Communications	23,785	18,596	- 5,189
Utilities & Sanitary Service	5,055	4,124	- 931
Wholesale Trade	8,194	8,135	- 59
Retail Trade	49,861	44,754	- 5,107
Finance, Ins. & Real Estate	6,951	8,088	1,137
Personal Services	20,397	18,183	- 2,214
Professional Services	27,179	30,907	3,728
Recreational Services	2,123	1,797	- 326
Public Administration	10,118	12,705	2,587
Armed Forces	271	784	513
NOT REPORTED	4,563	14,914	10,351

TABLE 1-9
SOCIO-ECONOMIC CHARACTERISTICS
PENNSYLVANIA STATE PLANNING SUB-REGION 10
(For dates and periods indicated)

ESTIMATED POPULATION 1965		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	890,200	Number	884,381	424,450	459,931	20,804	224,648	638,929
Absolute Change 1960-1965	5,800	Percent Distribution	100.00	47.99	52.01	2.35	25.40	72.25
Percent Change 1960-1965	0.66	Percent Change 1950-1960	-9.61	-11.25	-8.05	-52.55	10.69	-12.67

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	31,161	25,338	103,589	57,991	17,779	235,858
Percent Distribution	13.21	10.74	43.92	24.59	7.54	100.00
Percent Change 1950-1960	-53.81	-60.92	15.48	331.00	405.09	-4.29

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	552,945	238,399	242,740	51,253
Percent Distribution	100.00	43.11	43.90	9.27
Percent Change 1950-1960	-6.87	-20.11	12.63	14.05

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	312,818	34,097	195,675	26,581	117,143	7,516
Percent Distribution	90.17	9.83	71.84	28.16	93.97	6.03
Percent Change 1950-1960	-11.03	29.11	-20.58	18.81	11.35	86.13

RATE OF UNEMPLOYMENT, 1962-65

1962	10.1
1963	9.7
1964	6.7
1965	6.3

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	347,699	320,608	223,025	91,147	124,674	229,461
Percent Distribution	52.03	47.97	70.99	29.01	35.21	64.79
Percent Change 1950-1960	-8.08	-15.87	-17.09	-6.50	14.09	-19.10

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	%
Tot. Work Force	344.8	- 3.5	- 1.01
Tot. Employment	323.1	9.8	3.1
Unemployment	21.7	-13.3	-38.0

centers. The individual areas are described in the following paragraphs, within the context of the counties whose economic activities they dominate.

Scranton-Wilkes-Barre-Hazleton

Lackawanna and Luzerne Counties are coterminous with the SMSAs they contain: Scranton, in Lackawanna County; Wilkes-Barre-Hazleton, in Luzerne County. The combined SMSAs are designated as a regional growth center by the Appalachian Regional Commission.*/

The physical environment of these urban centers reflect the history of anthracite mining. The Scranton and Wilkes-Barre - Hazleton areas did not enjoy the post-war prosperity experienced by most other urban areas in the U.S. Yet, it is the urban complex of the area that has enabled the two counties to offset effects of the dying anthracite industry. It is this same complex that may ultimately enable Water Sub-region A to develop a vigorous economic structure.

Scranton, Wilkes-Barre and Hazleton were initially better able to withstand the decline in mining than were the smaller communities of the water sub-region. These three communities have had proportionately larger manufacturing, trade, and service sectors than smaller communities.

Since anthracite mining was a relatively small sector of economic activity, a given percentage decline in mining activity has had less impact on the growth area than on the small mining communities. Furthermore, these growth communities with their diverse socio-economic structure are more adaptive, and more responsive, to the introduction of new industry.

Current conditions in the area reflect the progress of the past decade. Unemployment rates have dropped dramatically since 1958. Average income levels have risen as new industries have moved into the area,**/ providing more and better job opportunities. These opportunities have also contributed to a decrease in rates of population out-migration.

---

*/ Expanded discussion of Lackawanna and Luzerne Counties is contained in An Environmental Study of Lackawanna and Luzerne Counties, Pennsylvania, by Arthur D. Little, Inc., report to the U.S. Army Engineer District, Baltimore, March 1968.

**/ Since 1966, among those that have located or enlarged plants in the area are: (a) Radio Corporation of America; (b) American Can Company; (c) Owens-Illinois Corporation; (d) Eureka-Carlisle Division of Little Industries; and (e) Shulton, Incorporated.

Development of efficient highway links to major metropolitan centers has played a key role in spurring growth. Progress has also been made in repairing some of the physical damage caused during the mining era. Local initiative, coupled with federal aid programs, has been the most important element contributing to the resurgence of the area's economy.

Transportation and utilities provide the area with excellent service. They will continue to be a positive factor in attracting additional industry in the near future. An excellent railroad system in terms of trackage and destination points provides adequate service for the movement of goods, although passenger service has been curtailed. Air service, now limited, is scheduled for expansion, thus further enhancing the area's accessibility.

The quality of water available for industrial and residential use is adequate to meet the needs of increased economic activity in the near future. Flow augmentation on the Lackawanna River will be necessary if the river continues to be used as a disposal system for industrial and residential wastes in the area. While the organic waste problem is being solved by sewage treatment facilities, means of coping with mine acid pollution are inadequate.

Land available for industrial expansion in the two-county area is ample for needs through 1980. Deficiencies in certain localities, such as the Greater Scranton Area, are evident, however.

The estimated*/ 1965 population of the regional growth center was 574,000, about 84 percent of Water Sub-region A's population (Figure 1-23).

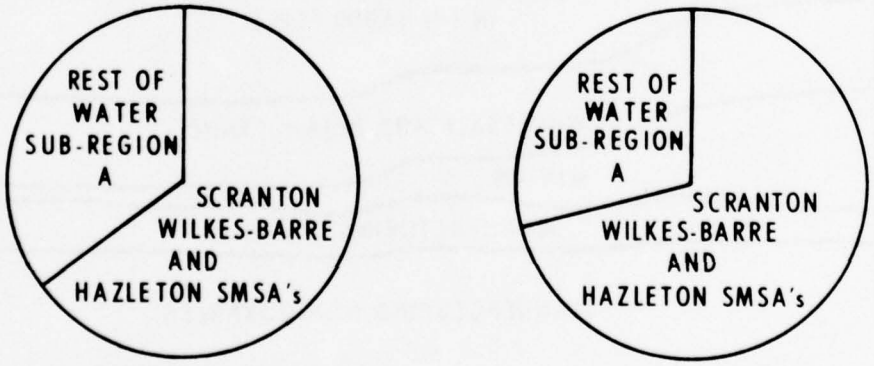


Figure 1-23 - Population and Employment, Scranton, Wilkes-Barre, and Hazleton SMSAs Compared to Water Sub-region A, 1965.

---

*/ Source: Intercensal Population Estimates, Pennsylvania State Planning Board, 1 May 1966.

This represented a decrease of almost 12 percent over 1950 population levels (649,503), as shown on Figure 1-23, a decrease of 1.2 percent over 1960 levels (581,505); and 65 percent of total 1965 population in Water Sub-region A. The area's proportion of total 1965 employment in Water Sub-region A amounted to 71 percent in 1965.

Total employment in the Luzerne and Lackawanna County area declined during the period 1950-1962, but rose after 1963 (see Figure 1-24). Although the total civilian labor force declined 16 percent during the period 1950-1964, it leveled off in 1965, and showed significant increases in 1966. Employment declined more rapidly for the area than the labor force therein from 1960-1962.

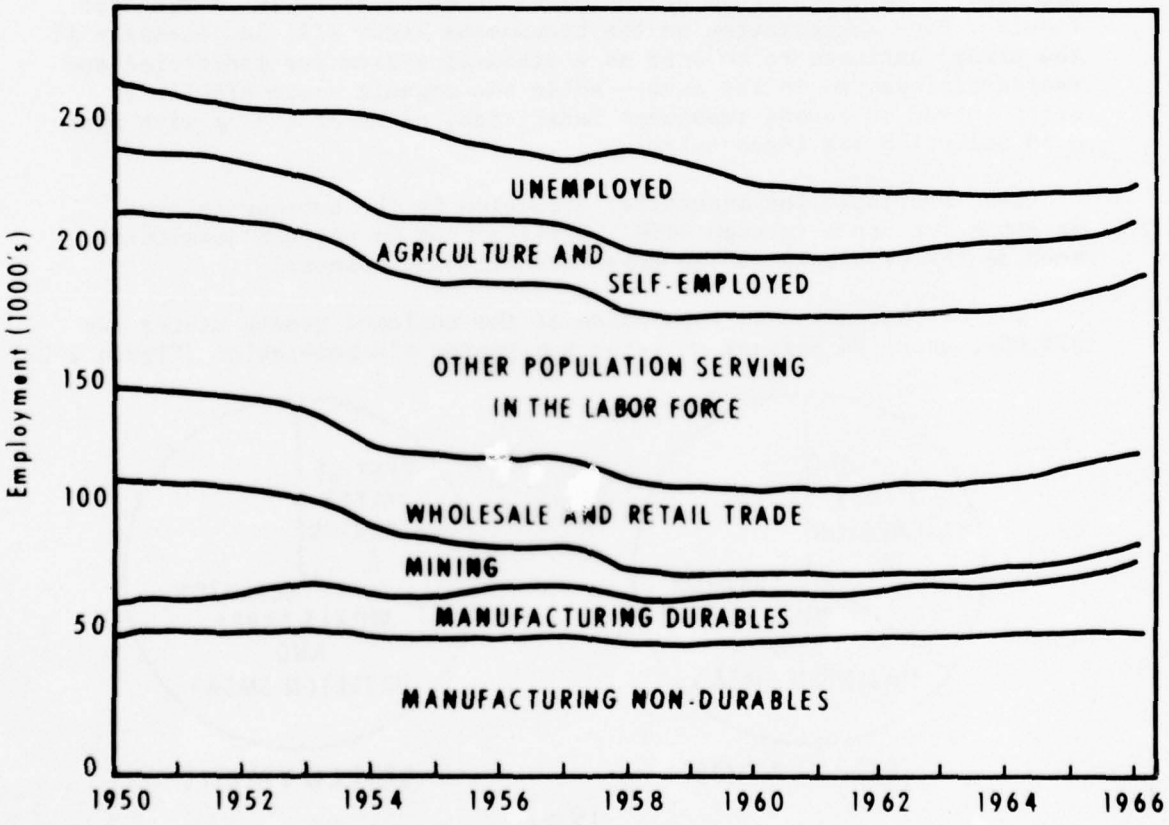


Figure 1-24 - Civilian Labor Force and Current Trends in Luzerne and Lackawanna Counties, 1950-1966.

Increases in the labor force since 1964 indicate that out-migration has slowed to the point where it is less than the natural increase in the population reaching the labor force age group. At the same time, more job opportunities have become available, thus contributing to a reduction in out-migration rates.

Analysis of the 1963 Census of Manufacturers indicates that the two-county area has relatively lower productivity, in terms of the ratio of value added to employment, than does Pennsylvania. For manufacturing as a whole, value added per employee is substantially lower for the study area than for the state.

Part of the difference is to be explained by the difference in the industrial mix of the two areas. Lackawanna and Luzerne Counties had a substantially greater proportion of manufacturing employment in the lower productivity industries. Additionally, the study area has generally shown less value added per employee than has the state, exceptions being limited to tobacco and leather products. Some of the lower productivity in the two-county area is due to the shorter work week that was experienced in these industries during 1963.

Manufacturing employment rose during the period 1950-1966, with the exception of the recession years of 1954 and 1958. Expansion of manufacturing activity, however, was not sufficient to overcome employment declines in the anthracite industry during the period. Consequently, total employment has shown decreases.

The manufacturing sector has shown the greatest amount of growth in employment since 1950, relative to total employment. This relative growth, however, is not in evidence for all components within the manufacturing sector. In particular, textile employment declined to slightly less than half of its 1950 level during the period 1950-1966; from 13,500 to 6,100, respectively. This decline occurred primarily because much of the textile industry moved to the south during the period.

The largest non-durable industrial sector in the area is apparel. It is labor-intensive and, consequently, sensitive to wage costs. A dominant factor in the movement of the apparel industry into the area has been the availability of low-cost labor. As the area diversifies its manufacturing base, and returns to full employment with wage levels rising toward national averages, it will become less attractive to apparel manufacturers. This situation is already evident in reduced rates of increase in apparel industry employment over the last three years.

Employment in durable goods manufacturing has shown a long-term upward trend, which is expected to continue. Non-electrical machinery

and electrical machinery are expected to continue as the largest growth industries in the durable goods sector. A significant change in the mix of the manufacturing industries in the near future is suggested below.

TABLE 1-10

PROJECTED INCREASE AND LEVELS OF EMPLOYMENT
IN LACKAWANNA & LUZERNE COUNTIES, 1960-1980

	1960	Annual Growth Rate	Increase	1980
Total Employment	204,300	1.2	50,300	254,600
Manufacturing	71,100	1.7	27,700	98,800
Durables	17,600	3.1	21,000	38,600
Non-Durables	35,500	0.6	6,700	60,200

SOURCE: Arthur D. Little, Inc., estimates based on County Business Patterns, and Pennsylvania State Department of Employment Security data.

In the non-durable goods sector, textiles will probably continue its downward trend. The apparel industry, recently a growth industry, and the largest single employer in the area, is likely to reach a plateau in the near future and thereafter, decline.

Per-capita income is expected to rise in Lackawanna and Luzerne Counties through the year 1980. This growth will result largely from an increase in the proportion of people employed in higher wage industries, as well as from a general rise in real wages in all industries.

If the two-county area is to attract growth industries in the near future, such as electrical and non-electrical machinery, capabilities for handling increased freight movements must be developed. Wilkes-Barre and Scranton are both well located for a facility that would provide warehousing or in-transit fabricating of raw materials originating in the west and destined for the Atlantic Coast. Such a facility has been suggested for Pittston.

If current trends are maintained, and if the Interstate Highway System is completed as scheduled, annual tourist expenditures for the area can be expected to double by 1980. This growth is expected in

the recreation sector without enhancement of existing facilities or development of new attractions. Such growth will, in turn, lead to new business opportunities in restaurant, gift shops, and other service facilities. It is possible to expand the recreation industry significantly beyond projected levels if new attractions are developed, existing points of interest enhanced, and the area adequately promoted.

Activities related to agriculture will occupy a smaller part of total economic activity. Farming will be restricted primarily to small-scale dairying, poultry operations and truck farming. Because of generally poor quality of timber stands, the small size of forest ownerships, and the need for better forest management, an intensified forest management program must be initiated if forest resources are to approach their potential benefits to the local economy.

Pottsville

Schuylkill County's urban areas, dominated by Pottsville, can be divided into two categories primarily on the basis of population size:

(1) The first category consists of the primary growth center of Pottsville, and satellite communities of Shenandoah, Mahanoy City, and Tamaqua. Included with these communities are adjoining smaller communities that are tied to Pottsville;

(2) The second category is composed of numerous small villages, hamlets, and unincorporated areas found scattered throughout Schuylkill County, and which are functionally unrelated to Pottsville.

Pottsville has held up well through over three decades of economic retrenchment. Nonetheless, a number of satellite communities, especially the smaller, strip villages, clearly show the impact of past economic difficulties.

For some mining areas of the county, subsidence, culm and spoil piles, and mines fires pose serious problems. For others, their small size virtually prohibits them from developing those facilities and services normally found in a community. A third impediment existing in some of the smaller communities is the isolation they experience due to the difficulty of maintaining adequate access to the rest of the county and beyond.

The problem of linking Pottsville with various metropolitan areas of the region has been approached by civic leaders interested in a "Lakes-to-Sea" expressway. This expressway would connect Interstate 80 (the Keystone Shortway) with Interstate 78 (State Route 22). Improvement of present airport facilities is also necessary to enable economic expansion in the near future.

The estimated*/ 1965 population of Schuylkill County was 177,100. This represented a decrease of 11.7 percent under 1950 population levels (200,495); and increase of 2.4 percent over 1960 levels (173,027), and 20 percent of total 1965 population in Water Sub-region A.

During the period 1950-1965, employment decreased by 13 percent to a level of 63,800. The change over 1960 employment levels (60,719) amounted to 5.1 percent. The county's proportion of total 1965 employment in Water Sub-region A amounted to 19.4 percent in 1965. Population and employment are depicted in Figure 1-25.

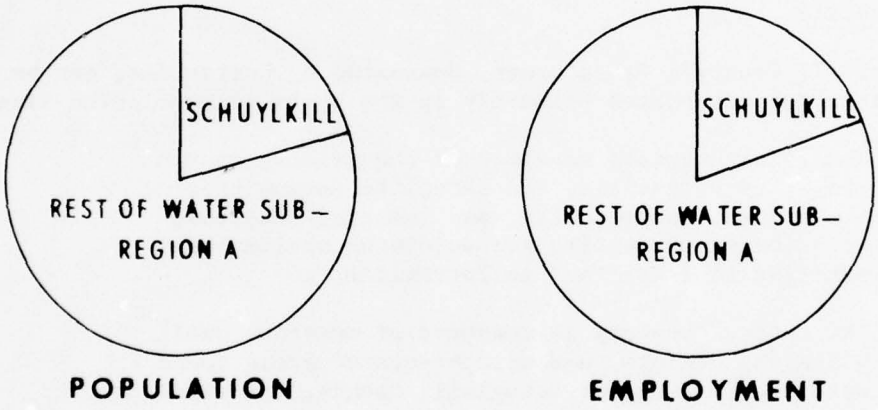


Figure 1-25 - Population and Employment in Schuylkill County Compared to Water Sub-region A, 1965.

Prior to 1930, anthracite mining was the outstanding activity of the area's economic base. Drastic reductions in anthracite employment has reduced mining to a second place in the county behind manufacturing. In 1961, anthracite employment was 5,553, producing a total product valued at $54 million. Industries traditionally dependent upon mining activities such as trade and transportation have been seriously affected. In addition, the practice of strip mining has made many areas virtual waste lands. Urban areas are affected by the problem of subsidence due

---

*/ Source: Intercensal Population Estimates, Pennsylvania State Planning Board, 1 May 1966.

to abandoned mines and underground fires. Basic changes in the character of the land has led to significant problems of drainage, and to pollution of the water supply. Partially resulting from the long reign of anthracite mining, a large proportion of the county's labor force has skills that are not in demand, or pay low wages. The major occupational category of the labor force is the Operatives. This group accounts for 39.5 percent of the labor force in the county, as compared to only 18 percent on the national average. Composition of the Operative group is primarily restricted to semi-skilled workers who previously made their living in mining and transportation.

Contrasted to the relatively high amount of low-skilled labor, there are few professional, managerial, clerical, and service workers in the area. These groups are becoming more important to the national economy. This importance is, in turn, reflected in their wage levels. To overcome problems such as these, the Greater Pottsville Industrial Development Corporation (GPIDC) was formed. The GPIDC has been successful in financing new industries and attracting many new industries into the Pottsville area.

Since 1957, more than 30 new companies, as well as 15 expansions of existing industries, have occurred in the area. Companies in the Pottsville area represent a wide spectrum of products including plastic film, plastic fabrication, shirts, field products, mirrors, frames, lighting fixtures, bottle caps, mattresses, mobile homes, tying devices for construction industry, envelopes, planetariums, brass products, pens and pencils, armored cables, tapestry and upholstery fabrics, bearings and bushings, and heating equipment.

Manufacturing is the largest source of income for the area as well as the foundation of its economic base. In 1962, there were 324 manufacturing establishments in the area employing over 22,000 people. For the same year, manufacturing accounted for an annual payroll of $72 million. For the United States in 1960, 27 percent of total employment was involved in manufacturing; in Pennsylvania, 36 percent; in the county, 38 percent.

The county's manufacturing enterprises produce predominantly nondurable goods. The apparel industry accounts for more than 50 percent of all manufacturing employment and 30 percent of value added in manufacturing activities.

While apparel has been providing an increasingly greater number of jobs, its weaknesses must also be recognized. Apparel and textiles provide work mainly for women; the critical problem of full employment for the male segment of the labor force in the county is not resolved; and generally lower wages of the apparel industry reduce its total contribution to the county's economy. Concentration of the low-wage

textile and apparel industry in an area often precludes entry of more stable and higher wage industries.

Metal fabrication is the largest component of the durable products manufacturing group. The Alcoa Aluminum fabrication facility near Cressona is a major contributor to the component. Importance of such industries as the Alcoa plant to the area economy can be seen by comparing employment figures to wages paid in the county. Whereas apparel employed 50 percent of the county's labor force in 1962, this sector only returned 37 percent of the wages. Fabricated metals employed 3.5 percent of the labor force at the same time, but contributed 4.5 percent of the total wages paid.

Productivity in manufacturing, in terms of value added per employee, was $6,276 in 1961. This figure was substantially below the national and state figures due, again, to the dominance of apparel and textile activity. Since 1960, however, wider and more diversified industrial expansion has tended to raise value-added per employee.

Agriculture accounts for approximately 1.2 percent (1960) of the estimated income earned in Schuylkill County. Farm workers represent 1.7 percent of the county's population. Excess reliance on poultry and related products in the county has allocated a large portion of agricultural employment on an area where profit margins are limited, and competition severe.

Approximately 9,000 people, or about 15 percent of employed residents, commute to places outside county limits for their jobs. Those individuals commuting daily travel a one-way distance of up to 200 miles.

Recreation facilities provide several amenities to area residents. Pennsylvania State Game Lands, covering nearly 18,000 acres, are located in the county. Five blocks of state forest land, totaling 9,100 acres, also provide for public hunting. Nearly 26,000 acres on over 300 farms are open for hunting in three cooperative farm-game projects. An additional 31,000 acres of farmland are open to hunting through the Pennsylvania Game Commission's "Safety Zone Program."

Over 50 miles of trout fishing streams provide opportunities to participate in this type of recreation. Lakes and large ponds, totaling about 225 acres, provide fishing for bass, pickerel, blue gills, and bullheads. Public waters are stocked annually by the Pennsylvania Fish Commission. Many privately owned farms in the county operate fee-fishing enterprises.

Poconos Growth Area

The three northeastern counties of the water sub-region (Wayne, Pike and Monroe) together with about the eastern third of Carbon County, make up the famous Poconos recreation area. Although the Poconos Mountains are located primarily in Monroe County -- a focus for the area's growth -- they connote the recreational theme of development for the entire area.

Geography has played an important role in shaping the economy of the Poconos Counties. Rocky soils, rugged terrain, and a short growing season have placed severe limits on agricultural development. These factors, coupled with poor accessibility and an abundance of mineral resources have also inhibited manufacturing development in the Poconos Counties. On the other hand, the area's mountains, lakes, clean streams and wooded areas have provided a base for a major recreation resort industry.

There are no cities or boroughs with populations in excess of 7,500 within the Poconos Counties. Population concentrations are in and around the county seats: Honesdale, in Wayne County; Milford, in Pike County; and Stroudsburg, in Monroe County. Lehighton and Jim Thorpe, the County Seat of Carbon County, are both located along the western boundary of this predominately rural area.

The estimated 1965 population*/ of the Poconos Growth Area**/ was 138,800. This represented, as shown below, an increase of less than 10 percent over 1950 population levels (128,204), and an increase of under 7 percent over 1960 levels (129,854). The growth area accounted for 16 percent of total 1965 population in Water Sub-region A (890,200).

Monroe County, containing the Stroudsburg-East Stroudsburg Primary Growth Center, dominated the population increase over the period, although accounting for only 32 percent of the Poconos Counties' 1965 population. Over 50 percent of the 1965 population in Monroe County were centered in Stroudsburg and adjoining townships. The county showed population increases over the period 1950-1965 of 31 percent.

As shown in Figure 1-26, the proportion of Water Sub-region A's total 1965 employment attributed to the Poconos Counties amounted to 14 percent. In turn, Monroe County accounted for 45 percent of the 1965 employment in the Poconos Counties.

---

*/ Source: Intercensal Population Estimates, Pennsylvania State Planning Board, 1 May 1966.

**/ Carbon, Pike, Wayne, and Monroe Counties.

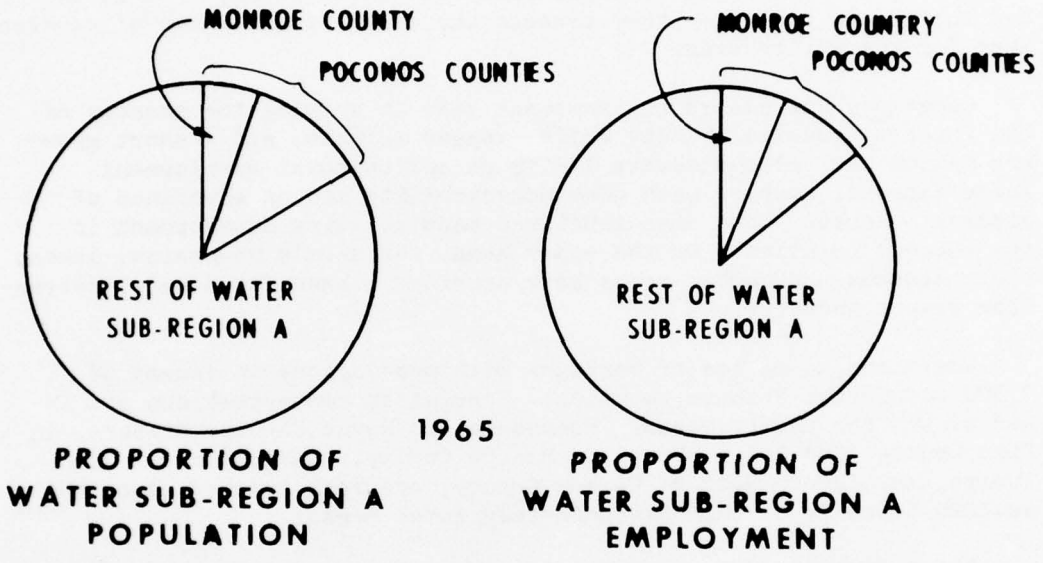


Figure 1-26 - Population and Employment in Poconos Counties Compared to Monroe County and to Water Sub-region A, 1965.

Although unemployment in the Poconos Counties has been consistently lower than the Pennsylvania average of 7 percent during the decade, 1950-1960, median family income was about 20 percent less than the state average in 1950, and 15 percent less in 1960. This reflects the effect of lower-wage industries dominant in the area, particularly apparel and recreation services.

Because of a relatively small employment base, and employment concentration in a few locations, fluctuations in employment can cause severe economic stress in these small communities. Stroudsburg and East Stroudsburg, with 60 percent of Monroe County's manufacturing jobs, and Honesdale, with an equal percentage of Wayne County's jobs, are particularly susceptible.

Principal natural resources with economic potential for the Poconos Counties will continue to be the scenic woods, hills, streams and lakes of the area. Completion of two interstate highways crossing Pike and Wayne Counties from east to west and Monroe County from north to south, will improve accessibility to the recreational resources of the area.

To date, the boom in vacation home development and the recreation services industry has been largely centered in Monroe County. Yet, the general similarity of the terrain throughout the area suggests that this type of development will be extended northward and westward as fast as better highway access permits.

In addition to increases in population and economic activity fostered by the improved accessibility to the surrounding population and manufacturing centers, the development of the Tocks Island National Recreation Area along the eastern borders of Monroe and Pike Counties is expected to give an even greater impetus to the expansion.

DEVELOPMENT
OF
WATER RESOURCES
IN
APPALACHIA

MAIN REPORT
PART II
SHAPING A PLAN

CHAPTER 2 - SHAPING THE PLAN FOR SUB-REGION A

TABLE OF CONTENTS

Par.	Subject	Page II-2-
	SECTION I - FUTURE GROWTH PATTERN	
1	WATER SUB-REGION A's PROJECTED DEVELOPMENT	1
2	DEVELOPMENTAL CONSTRAINTS	7
	General	7
	Industrial Development	9
	Water Control	10
	Water Supply	10
	Water Pollution	11
	General	11
	Mine Drainage	11
	Municipal and Industrial Wastes	12
	Recreation	12
	Removal of Developmental Constraints	17
3.	PATTERN OF GROWTH ANTICIPATED	18
	SECTION II - WATER RELATED NEEDS	
4.	INTRODUCTION	21
5.	WATER AND RELATED NEEDS	21
	Flood Control	21

CHAPTER 2 - SHAPING THE PLAN FOR SUB-REGION A

TABLE OF CONTENTS
(cont'd)

Par.	Subject	Page II-2-
	Water Supply	22
	Pocono Counties	22
	The Anthracite Counties	22
	Projected Demand	26
	Water Quality	29
	Pocono Counties, Stream Pollution	29
	Pocono Counties, Other Pollution Problems	30
	Anthracite Counties, Stream Pollution	30
	Land Development	31
	Industrial and Residential Development	36
	Recreation	36
	Power	40
6.	INTER-BASIN COMPATIBILITY	42
	Susquehanna River Basin	42
	Delaware River Basin	43
	Summary of Water Related Needs	44
	SECTION III - ALTERNATIVES FOR MEETING NEEDS	
7.	STRUCTURAL	46
	Anthracite Counties	46
	Scranton	46
	Wilkes-Barre	47
	Hazelton	48
	Pottsville	48
	Pocono Counties	49
	Stroudsburg-East Stroudsburg	49

CHAPTER 2 - SHAPING THE PLAN FOR SUB-REGION A

TABLE OF CONTENTS
(cont'd)

Par.	Subject	Page II-2-
	Jim Thorpe-Lehighton	50
	Honesdale	50
	Other Needs	50
8.	NON-STRUCTURAL	51
	SECTION IV - EVOLUTION OF THE SUB-REGION WATER RESOURCES DEVELOPMENT PLAN	
9.	SELECTION OF BEST SOLUTIONS	52
	Anthracite Counties	52
	Scranton	52
	Wilkes-Barre	53
	Hazelton	54
	Pottsville	55
	Acid Mine Drainage, Subsidence and Mine Flooding	56
	Abatement and Control Measures	57
	Pocono Counties	58
	Carbon County - (Jim Thorpe-Lehighton)	61
	Monroe County - (Stroudsburg-East Stroudsburg)	62
	Wayne County - (Honesdale)	63
	Mine Drainage and Pollution	64
10.	THE SYSTEM - SUB-REGIONAL	67
	General	67
	Flood Control	67
	Wyoming and West Wyoming (Luzerne County) Flood Protection Project	67
	Local Flood Protection at Wabash Creek, Tamaqua, Pennsylvania	68
	Plymouth, Luzerne County, Local Flood Protection from Wadham Creek	69

CHAPTER 2 - SHAPING THE PLAN FOR SUB-REGION A

TABLE OF CONTENTS
(cont'd)

Par.	Subject	Page II-2-
	Swoyersville and Forty-Fort (Luzerne County) Local Protection Project	69
	Blakely (Lackawanna County) Local Protection Project	70
	Restoration of Deer Lake Reservoir, Deer Lake, Schuylkill County, Pennsylvania	71
	Restoration of Lake No. 1 at Tobyhanna, Pennsylvania	71
	Water Supply and Water Quality	73
	Recreation	73
	Conservation	73
	Preservation of Surface and Ground Water Quality	73
	Lackawanna and Luzerne Counties	73
	Schuylkill County	74
	Carbon County	74
	Monroe, Pike and Wayne Counties	74
11.	SELECTED PLAN	75
	I - Immediate Implementation	75
	Element A	75
	The Lackawanna-Wyoming Valley Environmental Study	76
	Pennsylvania's Ten-Year Mine Drainage Pollution Abatement Program for Abandoned Mines	77
	Lackawanna River - Susquehanna River Mine Drainage Abatement, Subsidence Prevention, and Flood Protection	78
	Reclamation of Mine Disturbed Lands	79
	The Susquehanna River Basin Mine Drainage Study	79
	Accelerated Land Treatment Measures	80

CHAPTER 2 - SHAPING THE PLAN FOR SUB-REGION A

TABLE OF CONTENTS
(cont'd)

Par.	Subject	Page II-2-
	Element B - Structural Measures	80
	Corps of Engineers	81
	Pennsylvania Power & Light Company	81
	Upstream Watershed Projects (USDA)	81
	Projects Recommended for Authorization	81
	II - Implementation Within Five Years	81
	III - Implementation May be Deferred Five Years or Longer	82
	Element C - Non-Structural Measures	82
	Element D - Preservation of Quality of Ground and Surface Water	82
	SECTION V - PARTICIPANTS IN SHAPING AND EXECUTING THE PLAN	
12.	SHAPING THE PLAN	83
	Federal Agencies	83
	Non-Federal Agencies	84
13.	EXECUTING THE PLAN	84
	Responsibilities	84
	Element A	84
	Element B	86
	Element C	87
	Element D	87
	Coordination	87
	Introduction	87
	Requirements for Federal Projects or Federally Assisted Projects	88

CHAPTER 2 - SHAPING THE PLAN FOR SUB-REGION A

TABLE OF CONTENTS
(cont'd)

Par.	Subject	Page II-2-
	Corps of Engineers	88
	Department of Agriculture	88
	Requirements for Non-Federal Projects	89
	SECTION VI - DISCUSSION AND CONCLUSIONS	
14.	DISCUSSION	92
15.	CONCLUSIONS	94

CHAPTER 2 - SHAPING THE PLAN FOR SUB-REGION A

LIST OF TABLES

Table No.	Title	Page II-2-
2- 1	Population and Employment, Historical and Projected	2
2- 2	Population and Employment, Developmental Benchmarks	6
2- 3	Flood Control Needs and Residual Damages	24
2- 4	Gross Demand for Water Supply	27
2- 5	Net Demand for Water Supply	28
2- 6	Untreated Waste Loadings	32
2- 7	Treated Waste Loadings	32
2- 8	Land Use, 1975 and Projected to 2020	33
2- 9	Conservation Treatment Needs	34
2-10	Recommended Accelerated Land Treatment Measures and Installation Costs	35
2-11	Area in Urban Land Use	37
2-12	Urban Areas in the Anthracite Fields, Areas Disturbed by Mining, and Acreage Required for Expansion of Manufacturing Industry and Residential Areas by Year 2020	39
2-13	Summary of Water Related Needs	45

CHAPTER 2 - SHAPING THE PLAN FOR SUB-REGION A

LIST OF FIGURES

Figure No.	Title	Page II-2-
2- 1	Population Changes, Normal Development	1
2- 2	Population per Worker Ratio, Normal Development	3
2- 3	Per Capita Income, Normal Development	4
2- 4	Total Income, Normal Development	5
2- 5	Population Change, Stimulated Development	8
2- 6	Population per Worker Ratio, Stimulated Development	8
2- 7	Percent Total Income, Stimulated Development	9
2- 8	Acid Mine Drainage Pollution	13
2- 9	Major Water Quality Problem Areas	14
2-10	Unreclaimed Strip Mining Land 1965	15
2-11	Existing and Proposed Parks and Recreation Areas	16
2-12	Probable Growth Areas	18
2-13	Urban Centers	20
2-14	Major Damage Centers, Storm 18 August 1955	23
2-15	Location of Anthracite Fields and State Parks	38
2-16	Annual Activity Days	41
2-17	Water Resource Needs	44
2-18	Schematic of Water Needs and Alternative Solution - Susquehanna River Basin	59

AD-A041 387 CORPS OF ENGINEERS CINCINNATI OHIO F/G 8/6
DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. MAIN REPORT. PART--ETC(U)
NOV 69

UNCLASSIFIED NL

2 OF 7
AD
A041387

CHAPTER 2 - SHAPING THE PLAN FOR SUB-REGION A

LIST OF FIGURES
(cont'd)

Figure No.	Title	Page II-2-
2-19	Schematic of Water Needs and Alternative Solution - Delaware River Basin	65
2-20	Plan of Development	97

CHAPTER 2 - SHAPING THE PLAN FOR WATER SUB-REGION A

SECTION I - FUTURE GROWTH PATTERN

1. WATER SUB-REGION A's PROJECTED DEVELOPMENT

As is typical in the Appalachian Region, the Economy of Water Sub-region A lags significantly behind that of the nation. Without stimulation, economic expansion in the Water Sub-region appears limited.

An analysis of Office of Buisness Econimics' (OBE) projections, based on regional and national historical trends, indicates that, without an effective stimulation program, the Water Sub-region will not obtain economic comparability with the nation (See Table 2-1).

Figure 2-1 is a graphic comparison of national and sub-regional population conditions existing in 1960, and projected to the year 2020.

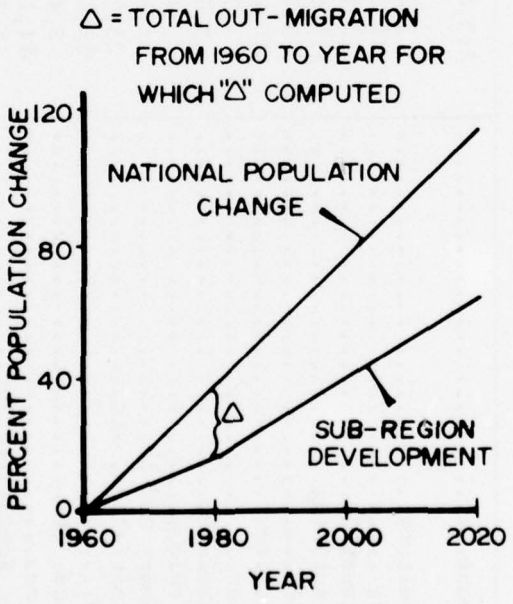


Figure 2-1 Population Changes, Normal Development

Table 2-1

POPULATION AND EMPLOYMENT
HISTORICAL AND PROJECTED
WATER SUB-REGION A

	1960	1980	2000	2020
Employment	313,602	362,000	446,000	564,000
Agriculture	7,381	4,000	4,000	4,000
Mining	15,188	5,000	5,000	3,000
Construction	15,196	18,000	23,000	27,000
Manufacturing	119,877	142,000	162,000	197,000
Food	8,721	8,000	6,000	5,000
Textiles	10,017	5,000	4,000	3,000
Paper	765	1,000	1,000	1,000
Chemicals	2,551	3,000	5,000	7,000
Petroleum	158	a/	a/	a/
Primary Metals	6,546	8,000	10,000	11,000
Transportation, etc	23,792	18,000	13,000	10,000
Trade	55,435	68,000	96,000	121,000
Finance, etc	8,483	12,000	14,000	14,000
Services	54,113	70,000	92,000	135,000
Public Administration	13,315	24,000	36,000	52,000
Armed Forces	822	1,000	1,000	1,000
Population	884,381	1,004,000	1,216,000	1,524,000

a/ Data not of sufficient size to warrant projection.

The projections are based on the assumption that there will be no special programs adopted to accelerate the growth of the economy of the Water Sub-region.

It is apparent that if the birth rate in Water Sub-region A only equals the national average, the forecasted population change indicates that the Water Sub-region will continue to lose its young people through out-migration. In addition, the projected population per worker ratio (Figure 2-2) indicates that the percentage of people who are unemployed, underemployed, or on welfare roles, will continue to be above the national average through year 2020.

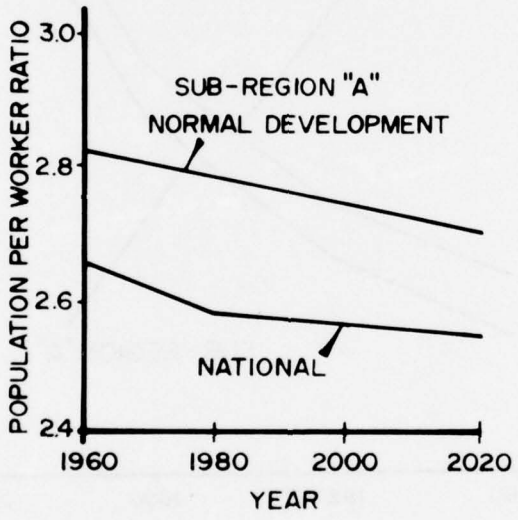


Figure 2-2 Population per Worker Ratio, Normal Development

OBE projections of national and sub-regional per capita income (1954 dollars) are compared in Figure 2-3. Here again, it is apparent that without stimulation per capita income in the Water Sub-region will still be 8 percent behind the national average by year 2020.

In comparing the Water Sub-region's eight-fold net change in total income, versus the nation's nine-fold increase during the period, 1962 to 2020 (Figure 2-4), we see that the Water Sub-region's net change is less than that for the nation. Water Sub-region A thus starts poorly in the economic race, and gets progressively poorer over time.

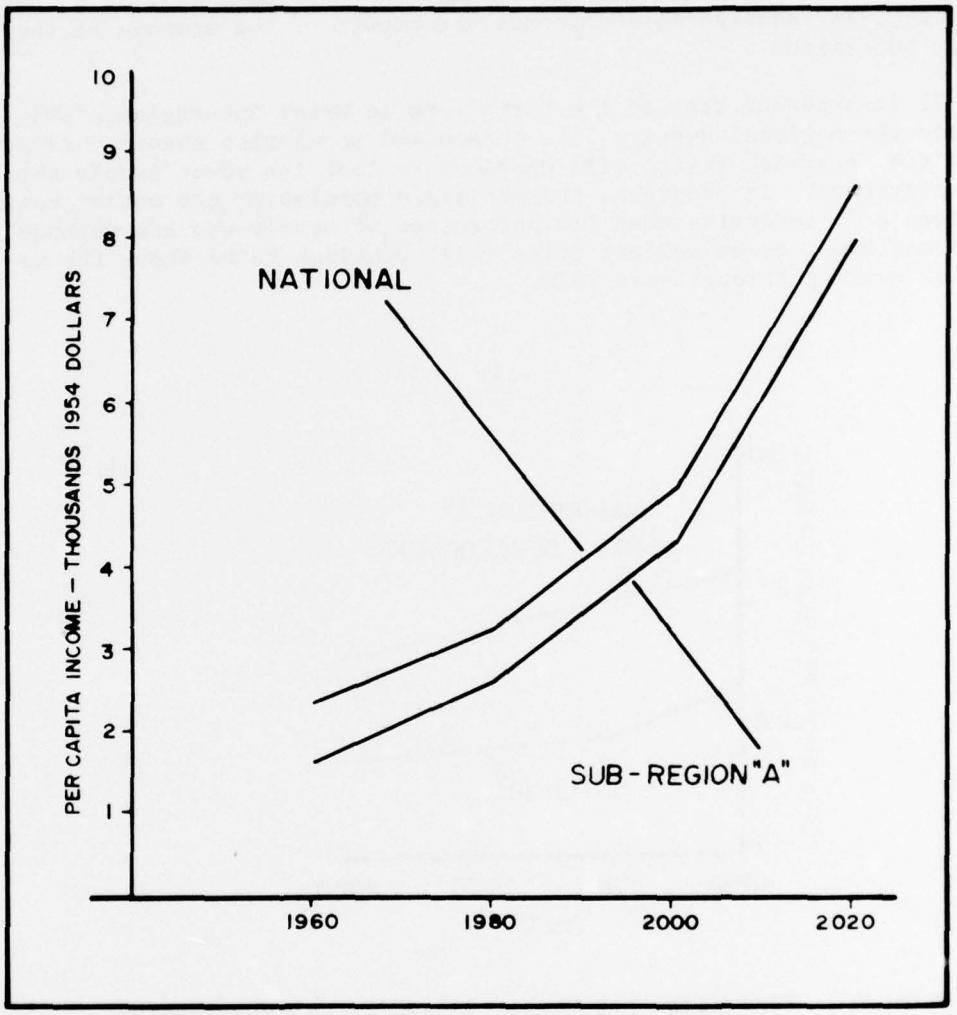


Figure 2-3 Per Capita Income, Normal Development (without stimulation)

The Appalachian Regional Development Act of 1965 has formally recognized that the Appalachian Region has not shared equally with other regions in the nation's prosperity. The Act has directed that efforts be made to aid the Region in obtaining this goal. In order to estimate the magnitude of effort required to achieve this end, it has been necessary to establish a set of minimum goals concerning levels of population, employment, and per capita and personal income that must be achieved if the Appalachian Region is to approach equality with national averages.

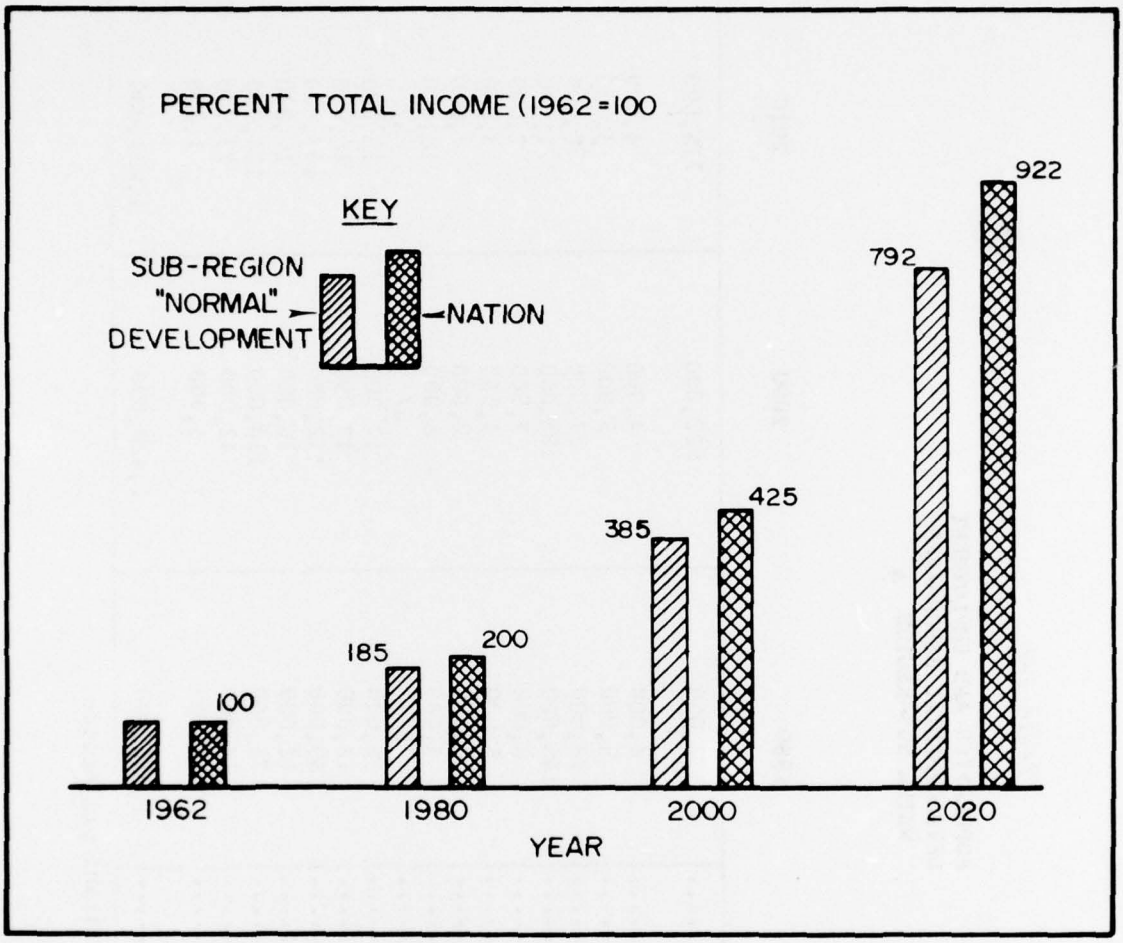


Figure 2-4 Total Income (National vs Sub-region), Normal Development

Relevant goals, or minimum levels of development required, were determined for each of the Water Sub-regions in the Appalachian Region, and were labeled "Developmental Benchmarks." (See Table 2-2.) These new objectives are intended to measure and describe the amount of growth that can occur as a result of an accelerated program of public investment for Water Sub-region A. They are based on the following assumptions:

a. Water Sub-region A will reach a per capita income of at least 95 percent of the national average by the year 2020.

Table 2-2

POPULATION AND EMPLOYMENT
DEVELOPMENTAL BENCHMARKS
WATER SUB-REGION A

	1980	2000	2020
Employment	372,000	522,000	775,000
Agriculture	4,000	4,000	4,000
Mining	5,000	5,000	3,000
Construction	18,000	27,000	38,000
Manufacturing	146,000	188,000	271,000
Food	8,000	7,000	7,000
Textiles	5,000	4,000	3,000
Paper	1,000	2,000	2,000
Chemicals	3,000	6,000	10,000
Petroleum	a/	a/	a/
Primary Metals	8,000	11,000	13,000
Transportation, etc	18,000	17,000	16,000
Trade	69,000	112,000	167,000
Finance, etc	12,000	16,000	19,000
Services	75,000	110,000	184,000
Public Administration	24,000	42,000	72,000
Armed Forces	1,000	1,000	1,000
Population	1,006,000	1,420,000	1,999,000

a/ Data not of sufficient size to warrant projection.

b. The Water Sub-region will maintain, after 1980, the same population relative to the United States.*/

In consonance with the intent of the Appalachian Redevelopment Act of 1965, development programs for Water Sub-region A must be designed to enable the economy of the Water Sub-region to eventually reach national comparability. To achieve 90 percent of national comparability by the year 2000 and 95 percent by 2020, the stimulated economy must do the following:

a. Reverse current trends of out-migration by 1980 and accommodate 204,000 more people by the year 2000 (1,216,000 "normal" versus 1,420,000 "stimulated").

b. Accommodate 470,000 more people by the year 2020 (1,524,000 "normal" versus 1,999,000 "stimulated" as shown in Figure 2-5.

c. Provide 10,000 more opportunities for employment by year 1980. (362,000 "normal" versus 372,000 "stimulated"). Provide 111,000 more employment opportunities by 2020 (564,000 "normal" versus 775,000 "stimulated"). Such action would result in a population per worker ratio of 2.58. This is the same as the national average. (Figure 2-6.)

d. Provide for a ten-fold increase (versus eight with "normal" development) in economic activity by the year 2020. (See Figure 2-7.)

This comparison shows that the growth rate in total income in the Water Sub-region (period 2000-2020) must exceed the national average in order to attain the desired 95 percent comparability.

2. DEVELOPMENTAL CONSTRAINTS

General

Having estimated the magnitude of increased economic activity which will be required in order for Water Sub-region A to attain 95 percent comparability with the National levels of affluence which are expected to prevail by year 2020, the next step in shaping a water resource development plan for achieving these goals requires identification (to the greatest extent possible) of existing or potential (water-related) constraints to such development. Having identified the general nature of

---

*/ A third implicit assumption is that labor force participation rates in the Water Sub-region will increase; and that, consequently, the population per worker ratio will decline.

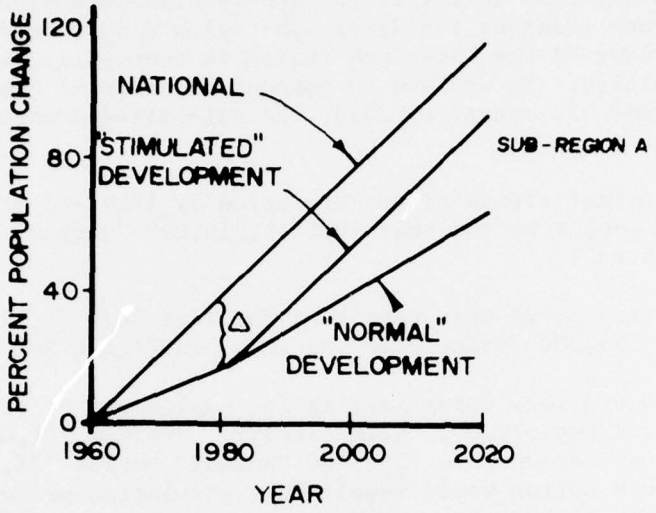


Figure 2-5 Population Change, Stimulated Development

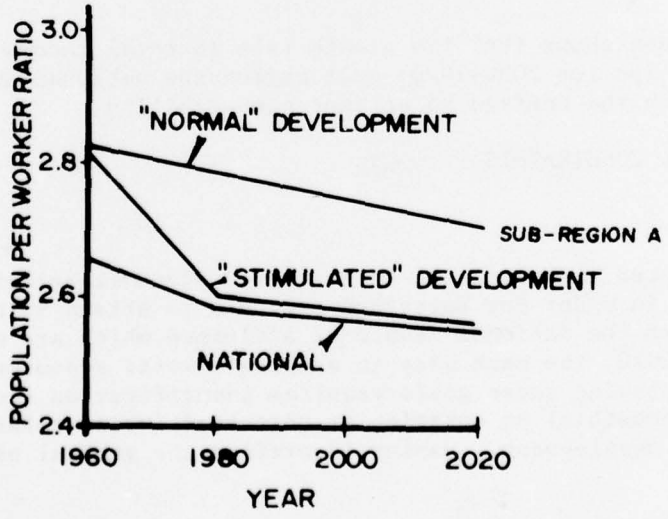


Figure 2-6 Population per Worker Ratio, Stimulated Development

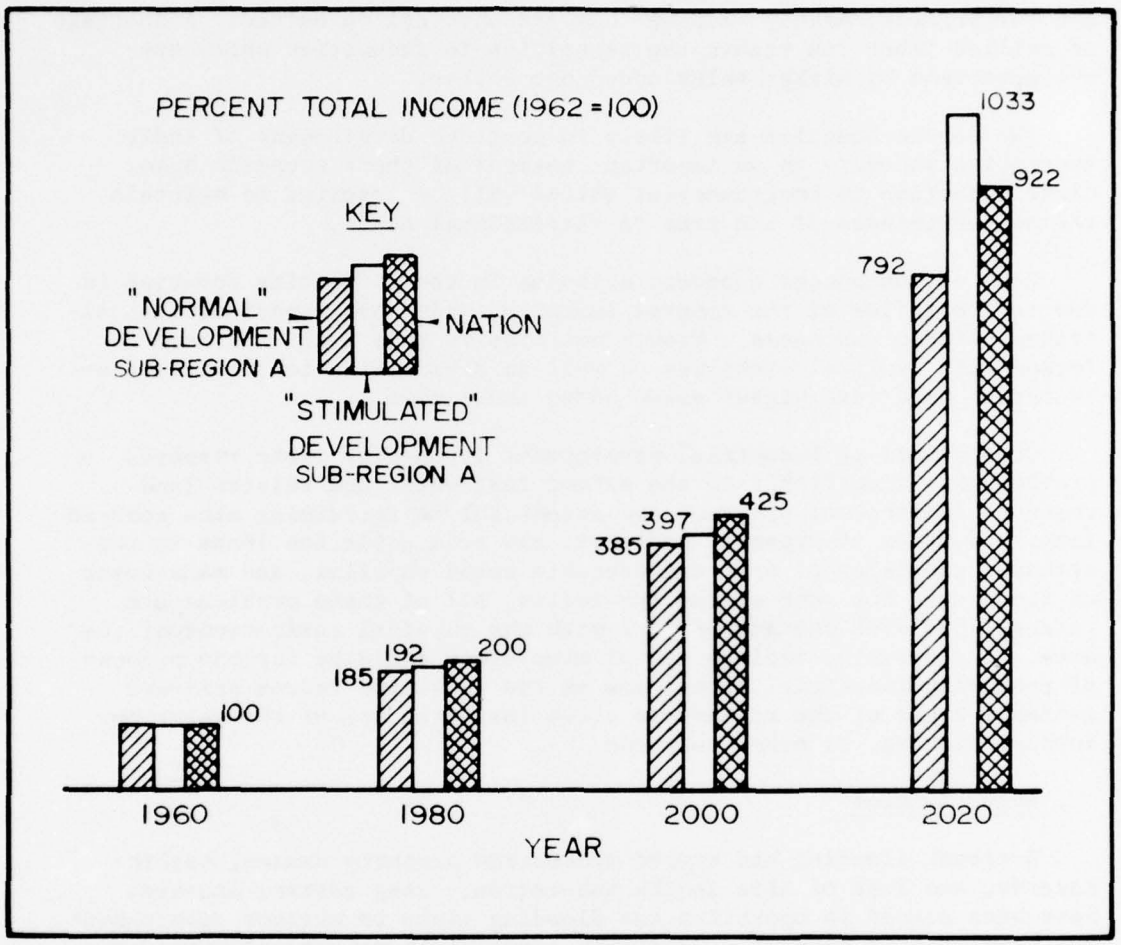


Figure 2-7 Percent Total Income, Stimulated Development

these constraints, programs for their reduction or elimination can be systematically planned. A balanced view of water resources in Water Sub-region A requires not only identification of adverse conditions, but also realization that much corrective work has already been completed, and that undeveloped potential for improvement of the social and economic environment exists.

Industrial Development

Constraints on potential industrial development in Water Sub-region A are physical and social. Many of the ravages left by mining activity

are correctable; mainly because they are physical in nature. A shortage of skilled labor can retard the transition to industries which are characterized by higher value added per worker.

The Pocono Counties are likely to continue development of their recreation industry as an important segment of their economic base. Close attention to environmental values will be required to maintain the attractiveness of the area to recreational users.

Some of the recent economic stimulus in the Anthracite Counties is due to the influx of the apparel industry, which has experienced accelerated defense purchases. Growth policies in this area will have to reckon with cyclical stability as well as diversification of the manufacturing base into higher value added industries.

Constraints on industrial development imposed by water resource problems are significant to the extent that water and related land resource development programs are successful in reclaiming mine scarred land; reduction of organic, sediment, and acid pollution loads in the streams; provision of safe and adequate water supplies, and management of flooding. For most of the sub-region, all of these problems are interrelated with one another and with the physical environment of the area. For example, reclamation of mine areas could be for the purpose of providing industrial sites, and at the same time reduce acid and sediment loads of the streams to allow increased use of the water for supply, fishing, or other purposes.

Water Control

Overbank flooding has caused widespread property damage, health hazards, and loss of life in the sub-region. Many control measures have been placed in operation and flooding risks to current development has been greatly reduced. Continued flood plain management based on structural and nonstructural measures will be required to maintain projected economic growth.

Water Supply

Fundamental among the opportunities for water resource development is creation of enlarged water supplies. Per capita needs increase annually; so must water supplies, even for areas with little population growth. Water shortages developed in Water Sub-region A during the drought of 1960-1966. This drought forced some communities to undertake emergency measures. In some places, accumulated surface water runoff deficiencies totaled 50 inches in a five-year period. Acid water and municipal pollution may reduce the desirability of using a water supply due to excessive costs of pre-treatment. Where such conditions prevail along with marginal reserves of water supply, economic development will be constrained.

Water Pollution

General

The Division of Sanitary Engineering of the Pennsylvania Department of Health has conducted extensive surveys, and has developed long-term programs for pollution abatement. Five distinct sources of pollution are specified in its reports: (1) acid mine water; (2) oil and gas well contamination of groundwaters; (3) municipal wastes; (4) industrial wastes; and (5) siltation from highway, dam and other construction projects. In addition to the five listed, agricultural runoff is also a source of pollution. Nutrients contained in agricultural runoff impair recreational and water supply use of reservoirs. As shown on Figures 2-8 and 2-9, in Sub-region A the major portion of stream pollution from both acid mine drainage and municipal and industrial wastes is concentrated in the Anthracite regions of Lackawanna, Luzerne, Schuylkill and the western part of Carbon Counties. Efforts by state and local agencies to attract new water-oriented manufacturing industries to this area have not been notably successful. U.S. Geological Survey Circular 526 singles out one underlying cause; due to pollutants, there are no streams traversing the Anthracite Counties that meet minimum industrial water quality requirements for most manufacturing processes. In addition, the Appalachian Location Research Studies Report of The Fantus Company, Inc., indicates that 35 percent of those industries considered suitable for location within the potential growth centers of the area are sensitive to industrial water quality and might refuse to locate because of the prohibitive costs of pretreating local water to meet minimum industrial standards.*/

Mine Drainage

Of the five pollutants, the most serious are mine acid and municipal pollution. The Division of Sanitary Engineering of the Commonwealth of Pennsylvania reports that many streams are acid from mine drainage. Many others are unusable because of minerals such as iron, manganese, aluminum, sulfates, and dissolved solids that come from mine wastes. By 1967, an estimated 2,750 tons of acid were pouring into Pennsylvania's three major river systems daily. Of this total, some 650 tons are attributed to tributaries of North Branch Susquehanna and Delaware Rivers which provide the main drainage for Water Sub-region A.

Perhaps surprising is the extent to which unreclaimed open-pit mining (see Figure 2-10) has affected streams and ground water in

---

*/ The adverse effect of such substandard water supplies on the economic growth potential of the Anthracite Counties is further reflected in a letter by the Director of Industrial Development, Pennsylvania Department of Commerce, to the Greater Pottsville Industrial Development Corporation, that states, in part, that as of 10 March 1966, there had been 15 to 20 instances of industries rejecting potential locations in Schuylkill County due to lack of availability (or high cost) of quality water.

the Anthracite Counties of Water Sub-region A. Open-pit mines not only result in pollution when coal seams are left exposed; water caught therein goes into the groundwater system that passes through abandoned deep mines, thereby polluting sources of groundwater supply as well. Where mining has been discontinued, discharges of pollution often continue. Figure 2-10 shows the extent of unreclaimed strip mined acreage in the sub-region in 1965.

Municipal and Industrial Wastes

Second to mine wastes in terms of seriousness, municipal sewage and industrial waste are responsible for widespread pollution in the Water Sub-region. The typical approach of municipalities in the past has been to use deep wells or impound small tributary streams for water supplies, and use rivers for waste disposal. Much corrective work is required as a consequence.

As with acid pollution from mines, the problem of municipal and industrial wastes is complicated by technical considerations. The most obvious of these is the degree of treatment this waste receives before it is returned to the stream. If rivers are to be returned to a "clean" condition, standards of treatment must rise.

The Pennsylvania State Sanitary Water Board has adopted regulations that will require upgrading of primary and intermediate treatment plants in Pennsylvania. Many small communities are finding the treatment costs high despite State and Federal grants. Some are joining their neighbors to build and operate plants to achieve large scale economies in their operation.

Recreation

Non-availability of adequate outdoor recreational facilities can be an important constraint on area development. Although sufficient data is not available to support a determination that an abundance of recreational facilities would inevitably attract new industry to an area, it is known that the outdoor recreational and aesthetic features of an area are carefully considered by management in making locational decisions. Given equality in other sectors affecting a locational decision, it is highly probable that management would choose not to locate in an area that was deficient in outdoor recreational facilities and which offered an unattractive landscape as well.

Figure 2-11 indicates the location of existing and proposed state parks and Federal Recreation Areas in the sub-region. Prospective needs for providing more facilities to support the needs of a rapidly expanding population in the Anthracite Counties is indicated.

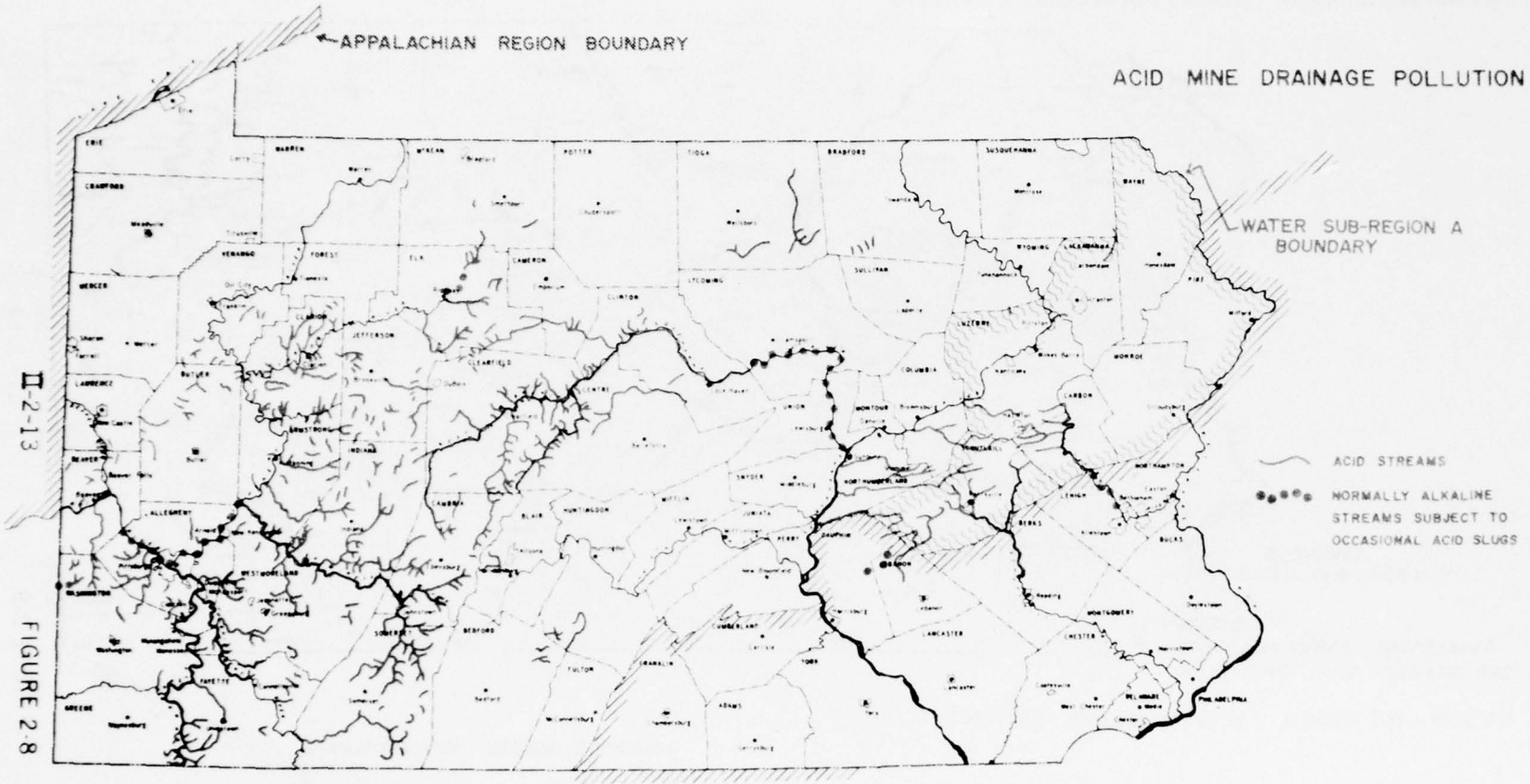

APPALACHIAN REGION BOUNDARY
ACID MINE DRAINAGE POLLUTION
WATER SUB-REGION A BOUNDARY
ACID STREAMS
NORMALLY ALKALINE STREAMS SUBJECT TO OCCASIONAL ACID SLUGS
SOURCE: PENNSYLVANIA STATE WATER SUPPLEMENT

FIGURE 2 8

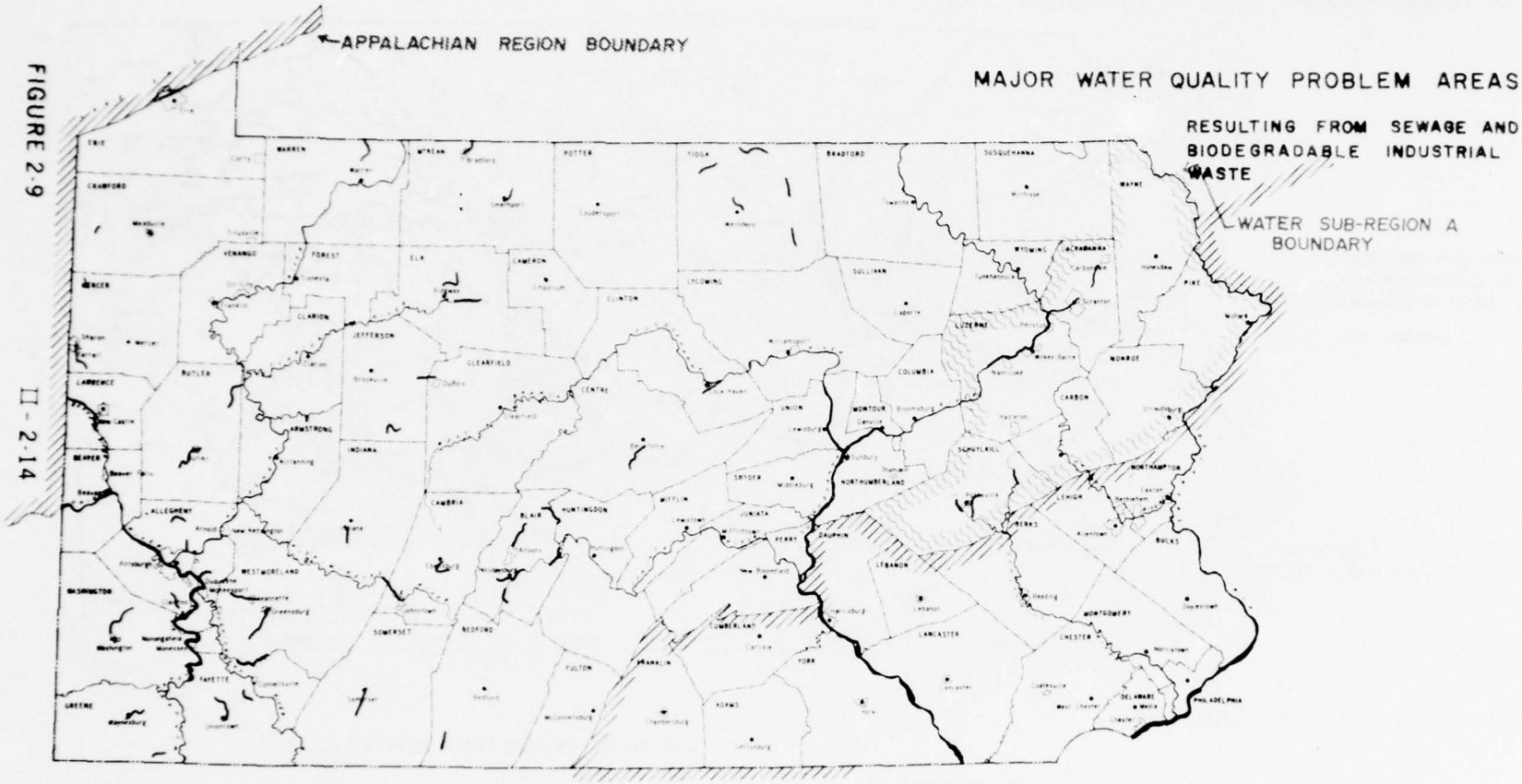
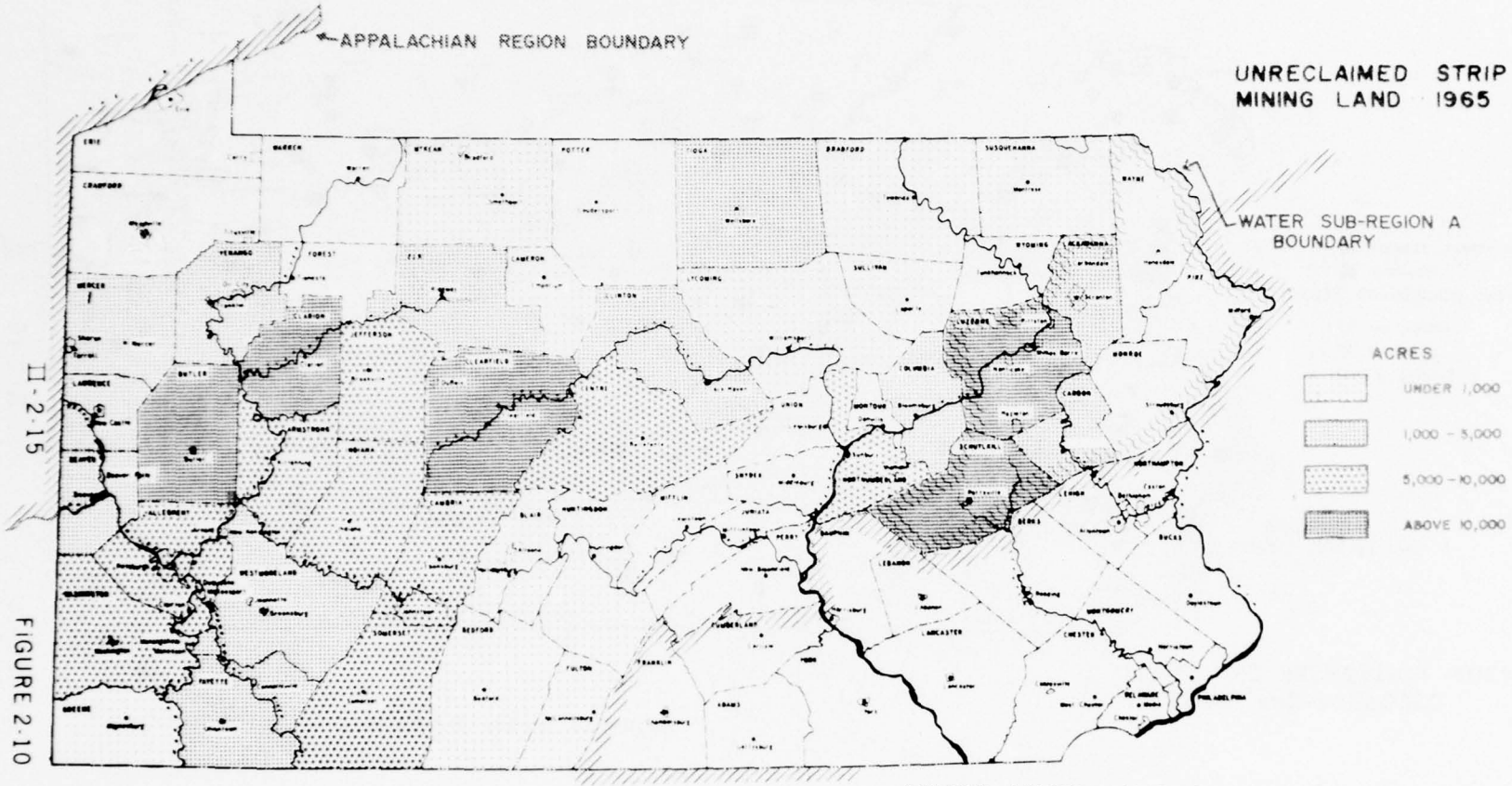

APPALACHIAN REGION BOUNDARY
MAJOR WATER QUALITY PROBLEM AREAS
RESULTING FROM SEWAGE AND BIODEGRADABLE INDUSTRIAL WASTE
WATER SUB-REGION A BOUNDARY
SOURCE: PENNSYLVANIA STATE WATER SUPPLEMENT

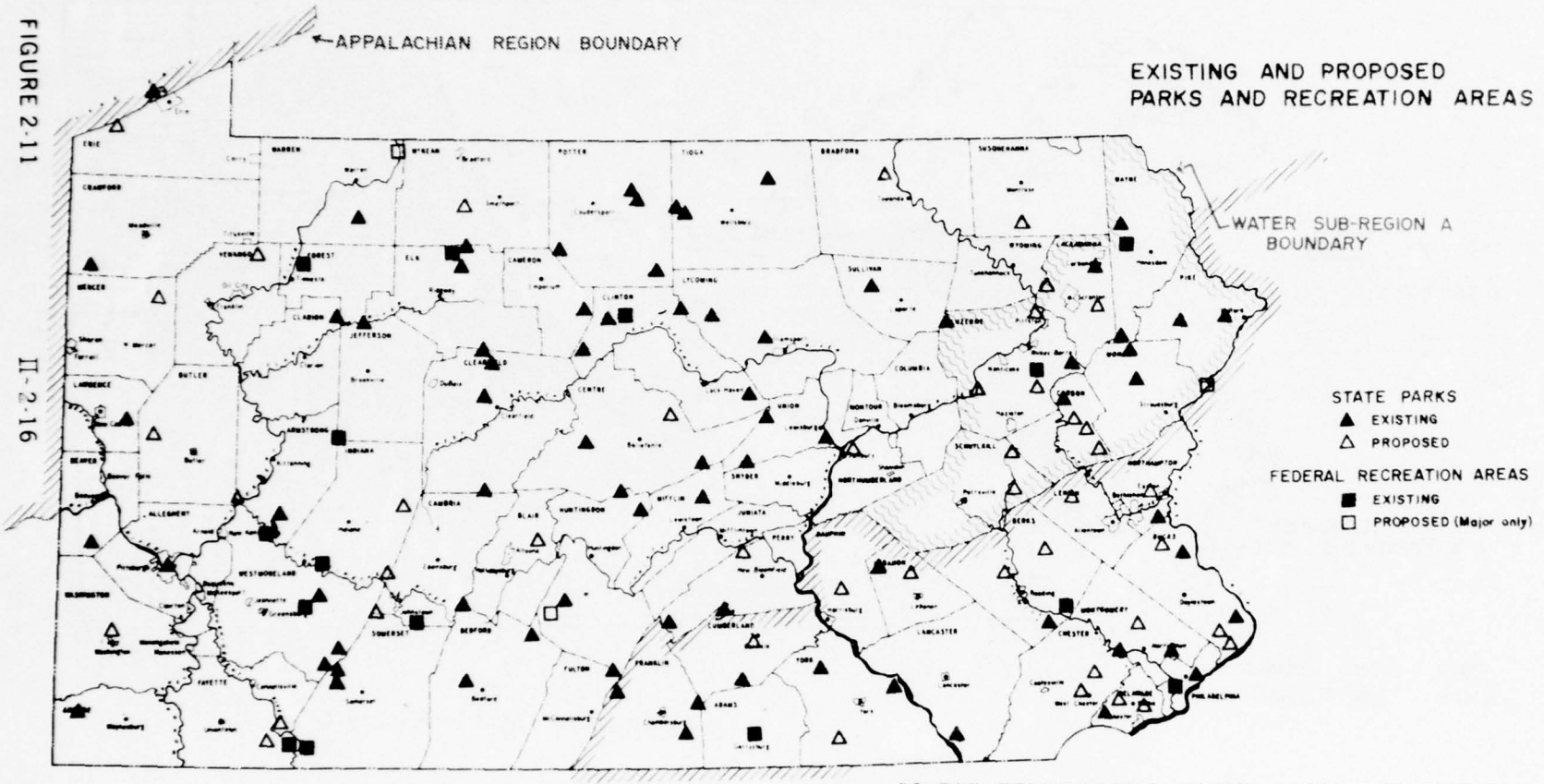
FIGURE 2-9



SOURCE: PENNSYLVANIA STATE WATER SUPPLEMENT

FIGURE 2-10

FIGURE 2-11



SOURCE: PENNSYLVANIA STATE WATER SUPPLEMENT

Removal of Developmental Constraints

Combined efforts to achieve water quality control, to prevent flooding, to promote recreation, to improve opportunities for industrial development, and to achieve numerous other objectives of water resources development are exemplified in Figure 2-20, Page 77. Therein is shown projects built, under construction, or recently funded. They are evidence that proper development of these resources has been a recurring objective of the Commonwealth of Pennsylvania, the U.S. Army Corps of Engineers, the USDA Soil Conservation Service, and other developing groups. In addition (not indicated in the figure), a ten-year mine drainage abatement program was instituted by the Commonwealth of Pennsylvania in 1965. This program was executed in cooperation with State and Federal agencies, most notably the Federal Water Pollution Control Administration and the Pennsylvania Departments of Health, and Mines and Mineral Industries. The latter agency has responsibility for mine sealing and backfilling operations and also building facilities for treatment of mine drainage.

Economic development of Water Sub-region A will require coodinated programs by federal state and local agencies. These programs must be designed to supply: (a) the initial impetus required to get the development program rolling; (b) the continuing pressure needed to accelerate it to the point that it becomes self-sustaining; and (c) the progressive elimination of existing deterrents to economic growth in the Water Sub-region.

Federal programs for stimulation should be designed to provide assistance under all applicable titles of the Appalachian Redevelopment Act of 1965. All projects should thus be planned and sequenced so as to provide maximum initial impetus toward economic growth, and continuous removal or elimination of existing deterrents to private investment throughout the Water Sub-region. Existing federal improvement programs should be utilized to the greatest possible extent. Funding and construction of previously authorized water resources projects must be coordinated with the stimulation program.

Planning and financial assistance provided under federal auspices must be augmented with planning, legislative, labor training, and construction programs at State and local levels. Such efforts should aim toward elimination of deterrents to the accelerated growth of private industrial investment within Water Sub-region A.

Such programs must consider: (a) required improvements in the Water Sub-region's secondary highway network; (b) changes in zoning areas; (c) elimination of health hazards stemming from inadequate treatment of sewage and industrial wastes; (d) control of water and air pollutions; (e) improvement of medical, educational, recreational and cultural facilities; and (f) creation of expanded facilities for continuous training of the labor force. In addition consideration must be given to programs for solid waste disposal subdivision regulations and proper development in resort areas, especially in the vicinity of the proposed Tocks Island Reservoir and Delaware Water Gap National Recreation Area.

3. PATTERN OF GROWTH ANTICIPATED

As indicated in the preceding discussions, Water Sub-region A is characterized by two separate areas of growth potential: (1) the Anthracite Counties (Schuylkill, Lackawanna, and Luzerne Counties); and (2) the Poconos Counties (Wayne, Pike, Monroe and Carbon Counties).

The Pennsylvania State Investment Plan designates Lackawanna and Luzerne Counties, with principal urban centers at Scranton, Wilkes-Barre, and Hazelton, as areas of greatest growth potential (Growth Potential Rating A). Schuylkill County, with a principal urban center at Pottsville, is given a rating of B. Carbon, Monroe, Pike and Wayne Counties are designated as rural. They have been assigned the growth potential rating of C.

With proper stimulation, intensified growth in manufacturing and supporting services is most likely to occur in the Anthracite Counties (Figure 2-12) where population, transportation and service centers that are vital for sustained economic growth, already exist (Figure 2-13). Growth in recreation-oriented industries and services can be expected to flourish in the Pocono Counties, which abound in natural beauty and developable resources for all types of outdoor recreation.*/

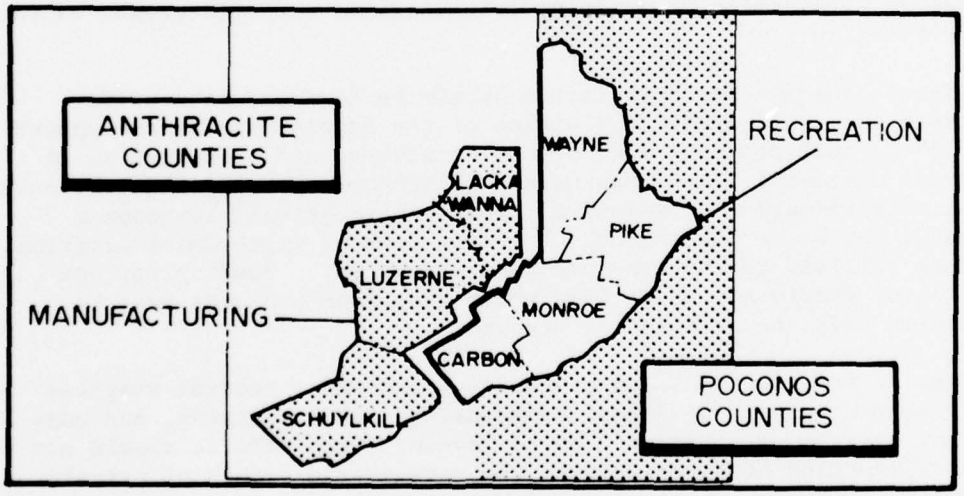


Figure 2-12 Probable Growth Areas

---

*/ This division of Water Sub-region A is in accord with the "Guidelines for Setting Appalachian Project Priorities," as discussed in Appendix B of A Plan for Public Investment in Appalachian Pennsylvania, submitted to the Appalachian Regional Commission by the Commonwealth of Pennsylvania, June 1967.

OBE projections for Water Sub-region A indicate that, during the period, 1960-2020, total employment will increase by 81 percent. During the same period, population is projected to increase by 72 percent. The higher rate of increase in total employment relative to population portends increasing per capita incomes for the Water Sub-region.

Employment increases in the service sector of the Water Sub-region are expected to contribute the largest estimated proportion of employment increase during the period, 1960-2020, with a projected increase of 149 percent over 1960 levels. Manufacturing employment is projected to increase by 126 percent. Other sectoral characteristics of the total employment picture for Water Sub-region A are shown in Table 2-2 above. Generally, decreases are expected in the Agriculture, Mining and Transportation sectors of the economy.

OBE developmental benchmarks for Water Sub-region A have been tested to assure the availability of sufficient land to support the projected industrial and residential growth. The test was applied under the assumption that 90 percent of the projected growth would take place in or near the existing urban centers in Lackawanna, Luzerne and Schuylkill Counties (see Figure 2-13). It is recognized that development of the Tocks Island Reservoir and Delaware Water Gap National Park will result in widespread growth of residential and commercial areas in Monroe, Pike, and Wayne Counties; but, in this part of the sub-region, there is no anticipated shortage of developable land.

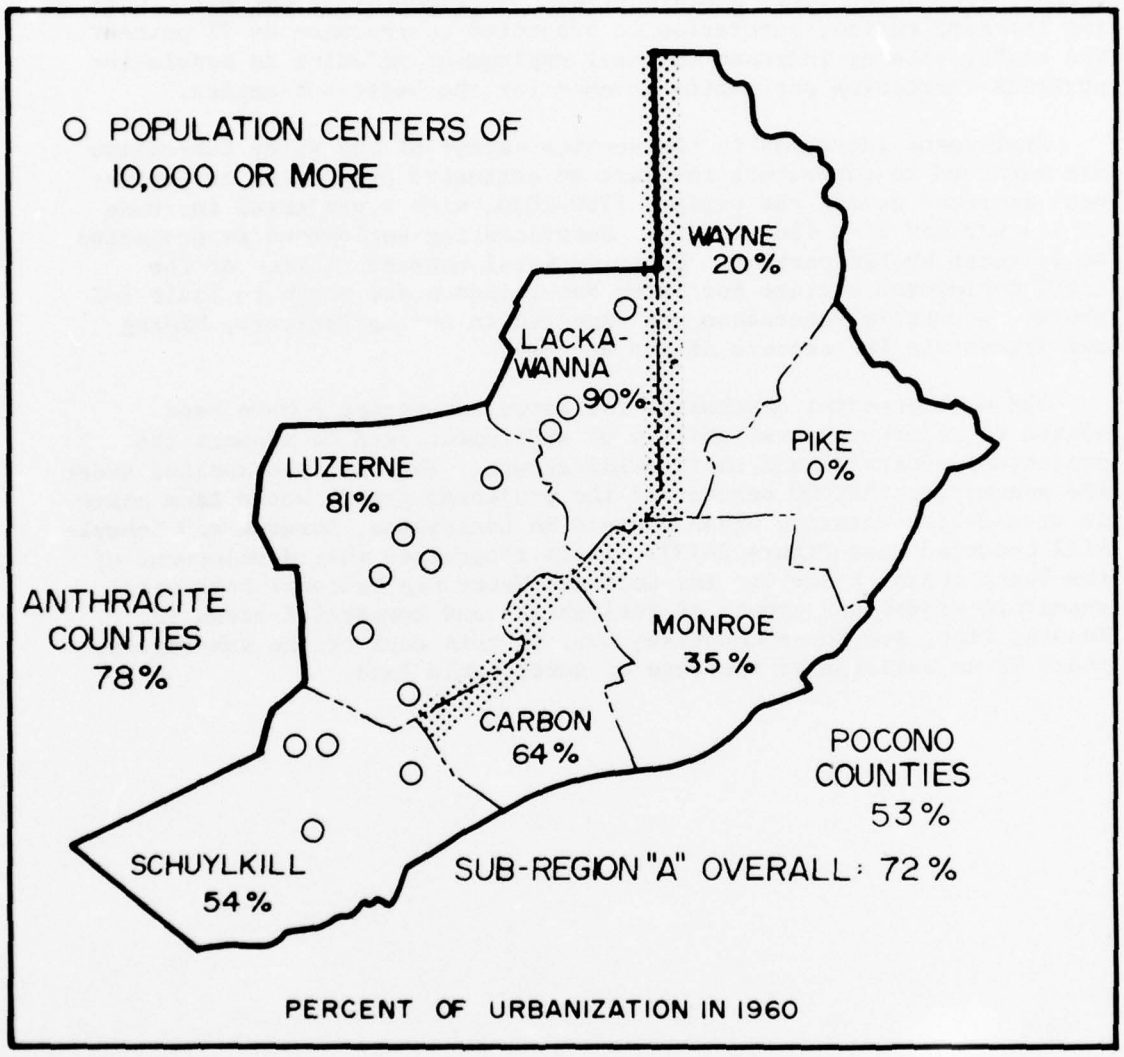


Figure 2-13 Urban Centers

SECTION II - WATER-RELATED NEEDS

4. INTRODUCTION

The inventory of water resources needs influencing economic growth in Water Sub-region A is diversified. Major categories in varying degrees of severity, but not in order of priority, are:

a. water quality improvement, and acid mine drainage abatement:

b. augmentation of water supplies;

c. local flood protection:

d. land treatment and watershed protection;

e. sedimentation control; and

f. outdoor recreation facilities.

Other needs related to power generation, irrigation and drainage exist, but in view of the fact that they are expected to be fully considered in planning for other water-use projects, they are not expected to inhibit economic growth in the sub-region. In this section, estimated and projected needs will be tabulated for the Water Sub-region as a whole, and, insofar as they can be localized, for the two growth areas individually. Projected needs are based on the assumption that the areas achieve their developmental benchmarks by year 2020.

5. WATER AND RELATED NEEDS

Flood Control

Due to mountainous terrain throughout the Water Sub-region, most of the highways, railroads and population centers are located in narrow stream valleys. These areas are subject to varying degrees of damage from floods that follow short periods of heavy rainfall. Although flooding frequency is low, significant damages and losses of life have occurred during previous floods. The flood following the passage of Hurricane "Dianne" over the region in August 1955, was the worst in history, on a region-wide basis. In addition to causing approximately $77*/ million in physical damages in Water Sub-region A, the flood

---

*/ 1967 price level.

claimed the lives of 63 people. Figure 2-14 indicates locations of major damage centers and total damages by counties experienced during the 18 August 1955 storm. Flood control works constructed since the August 1955 storm by both federal and state agencies have resulted in significantly abated flood damage in all the damage centers listed on Figure 2-14, and completion of all presently authorized projects will result in an even higher degree of protection particularly in the Pocono County area.

Table 2-3 shows existing average annual flood damages by county for all the major damage centers in the sub-region. These damages reflect the effects of all flood control works in place prior to 1967. Also shown are estimated residual needs after completion of authorized projects in place by 1980, and estimated residual damages as of year 2020 if all projects planned under the Appalachian Program and other Federal studies*/ were completed.

Water Supply

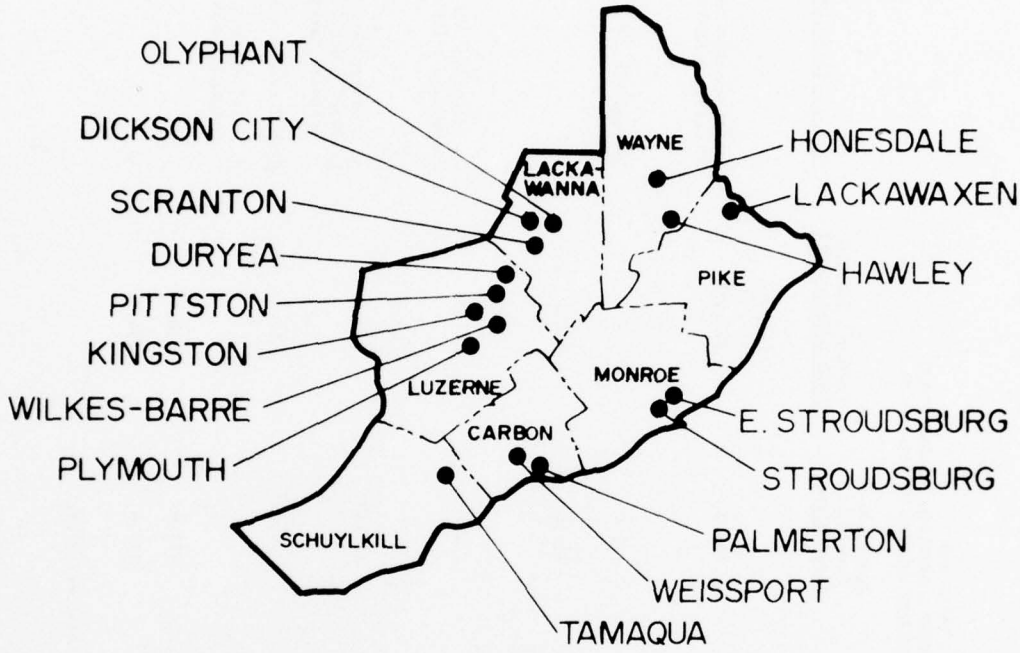
Historically, the provision of water and its distribution for consumptive purposes has not been an inhibiting factor in the social and economic development of Water Sub-region A. The underlying reasons for this situation are somewhat different for each of the two growth areas comprising the sub-region. As a result of these differences, together with the divergent socio-economic growth trends in the two areas, projections of future supply, demand, and needs relationships in the two areas, must be considered separately.

Pocono Counties. The major river systems draining rurally-oriented Wayne, Pike, Monroe and Carbon Counties are the Lackawaxen, Lehigh and Upper Delaware Rivers. These streams and their extensive tributary systems, along with many man-made and natural lakes and ponds throughout the area, have provided an abundance of high quality water for all types of consumption in this part of the Water Sub-region. In addition, high quality ground water is relatively plentiful and supplied about 40% of domestic and municipal requirements in 1965. Barring widespread pollution, due to uncontrolled residential and industrial waste disposal in this part of the sub-region, supplies are expected to be more than adequate to meet any conceivable consumer demand in the foreseeable future.

The Anthracite Counties. The major water courses available to the population centers in Lackawanna, Luzerne and Schuylkill Counties

---

*/ Delaware River Basin Report, adopted 1960. Susquehanna River Basin Report, underway.



SUSQUEHANNA RIVER BASIN

COUNTY	SUB-BASIN	TOTAL DAMAGES 1000'S OF 1967 DOLLARS
LACKAWANNA	LACKAWANNA R.	19,800
LUZERNE	SUSQUEHANNA R.	22,500

DELAWARE RIVER BASIN

COUNTY	SUB-BASIN	TOTAL DAMAGES 1000'S OF 1967 DOLLARS
WAYNE	LACKAWAXEN R.	4300
PIKE	LACKAWAXEN R.	7300
MONROE	BRODHEAD CR.	37,600
CARBON	LEHIGH R.	1200
SCHUYLKILL	SCHUYLKILL R.	4600

Figure 2-14 Major Damage Centers, Storm 18 August 1955.

TABLE 2-3
FLOOD CONTROL NEEDS & RESIDUAL DAMAGES $1000
ASSOCIATED WITH GROWTH CENTERS IN SUB-REGION A

Area 1 River (System)	Current Damages (1968)	Reduction by Projects expected to be in place by 1980	Residual Needs	Reduction by Structural Alternatives	Residual Damages (1968 Development)	Effective Projects
Anthracite Counties						
Lackawanna River	460.9	-	460.9		460.9*/	
Susquehanna River	941.4	-	941.4	546.0	395.4*/	Tentative structural measures Susquehanna Basin study (546.0)
Little Schuylkill	138.0	138.0	-		-	
Wabash Cr. (Tamaqua)	92.0		92.0	92.0	-	Tamaqua LPP (CE)(92.0)
Total (Anthracite Counties)	1632.3	138.0	1494.3	638.0	856.3	
Pocono Counties						
Delaware River Basin						
Wayne County	439.3	171.8	267.5	-	267.5	Greene-Dreher WS (USDA)(159.6) Lackawaxen Tribs. (USDA)(12.2)
Pike County	49.1	-	49.1	-	49.1	
Monroe County	749.3	67.1 a/	682.2	441.8 b/	240.4	a/ Brodhead Cr. WS (USDA)(67.1) b/ Small control structures - Delaware Basin study (CE)(441.8)
Carbon County	382.7	265.3 c/	117.4	36.0 d/	81.4	c/ Beltzville & Aquashicola Res. (CE)(265.3) d/ Small control structures - Delaware Basin study (CE)(36.0)
Total (Pocono Counties)	1620.4	504.2	1116.2	477.8	638.4	
Total Sub-Region A	3252.7	642.2	2610.5	1115.8	1494.7	

*/ Further modifications are anticipated with implementation of non structural measures.

are the Lackawanna, North Branch of the Susquehanna, Schuylkill, and Little Schuylkill Rivers. Parodoxically, these streams have carried an abundance of water through this part of the sub-region, but they have not been significantly drawn upon in the past, for either consumptive use or for industrial processes or products. There are several possible reasons for this:

(1) Historically, high quality water has always been available from the upland slopes of both the Wyoming Valley, in Lackawanna and Luzerne Counties, and the Schuylkill and Little Schuylkill River Watersheds, in Schulykill County. This water has been available in sufficient quantity to meet the needs for community growth, as well as an industrial water requirement which has been almost wholly associated with the anthracite mining and processing industry.

(2) Much of the process water for mining has come as a by-product of the mineral extraction operation itself, in the form of accumulations of underground mine water which was entirely suitable for flotation, washing, and other processing needs.

(3) The upland reservoir storage had the advantage of permitting gravity flow through many of the distribution systems.

This combination of circumstances has resulted in the development of a rather unique water supply system which has by-passed the most readily available sources (the rivers) and has concentrated on development of upwards of 100 relatively small reservoir impoundments in the upland area of the watersheds. In Lackawanna and Luzerne Counties, one privately-owned water utility company operates some 75 reservoirs (many of them with interconnecting pipe-lines) which feed by gravity conduit into an integrated, multi-community distribution system. This system serves some 90 percent of the two-couunty consumptive demand. The service area includes almost all of the Scranton-Wilkes-Barre-Hazelton SMSA, and extends throughout the Wyoming Valley, from Carbondale on the north, to below Nanticoke in the south. Similarly, in Schuylkill County, the major population centers of Pottsville, Mahonoy City, Shenandoah and Tamaqua are also served by upland reservoirs systems, but there are two notable exceptions; the reservoirs are generally not interconnected, and the individual systems are owned and operated by public water authorities.

It should be noted that the integrated supply system in the Wyoming Valley and the individual systems in Schuylkill County were developed by 1930 to the point where they were satisfying the consumptive demands of a population and industrial activity which was almost 25 percent greater than the 1964 level. This probably accounts, in part, for the fact that the major supplier in Lackawanna and Luzerne County has been able to cope with the current demands of its service area, even in the

face of the unprecedented five-year drought condition of the present decade. The same cannot be said of the smaller individual suppliers in the Three-County Anthracite area. During the drought period, supply and demand in the service areas of the smaller suppliers were in critical balance, and in several cases emergency methods for augmentation of supplies, such as water rationing, diversion from adjoining watersheds, and emergency treatment and use of acid water from mine catchments were required.

Projected Demand. The demand for water supply for municipal and industrial use as estimated by the FWPCA in Appendix D, Water Supply and Water Quality Control, is considered to be reasonable for planning purposes in Water Sub-region A. These estimates appear to be somewhat lower than those obtained by using the procedure followed in the preparation of the Delaware River Comprehensive Report. However, the share of heavy water using industries appears to be much smaller in the Upper Delaware as opposed to the lower basin. Thus, somewhat lower than the average "Delaware Basin" estimates of use would appear to be realistic. A summary of gross demand by county and growth area is presented in Table 2-4.

In considering availability of water to meet projected needs in the sub-region, there is no question of a sufficient quantity of natural flow to meet all foreseeable needs, in either the Anthracite or the Pocono Counties: the average flow in the Susquehanna River at Wilkes-Barre is more than 8,500 mgd which is equal to about 10 times the 2020 requirement for the Anthracite Counties, and the combined flows of the major streams in the Pocono Counties are far greater than any foreseeable needs. Thus, a limited amount of flow regulation could be indicated to meet water supply requirements. The possibilities for developing additional small reservoirs for augmenting existing supplies in this Three-County Anthracite complex are rapidly becoming limited. Many once feasible storage sites have been pre-empted by mining operations or other types of development. For the purpose of comparing available supply, demand, and remaining needs after 1980, it is assumed that existing utilities companies (private and public) will be able to expand their 1964 capacities by 30 percent through normal expansion measures planned by year 1980. This would amount to a potential capacity for domestic and municipal supplies of about 87 mgd. Augmentation over and above this amount would presumably have to come from the most economical of various alternative methods available, i.e., diversion from other basins, treatment of presently polluted sources, re-use, and/or other conservation techniques.

On this basis, net needs for water for domestic and municipal use in the Anthracite Counties would amount to about 73 mgd by 1980, rising to about 635 mgd by 2020, while net needs in the Pocono Counties are estimated to be 10 mgd in 1980, increasing to 78 mgd in 2020. (See Table 2-5). Gross demand for industrial water is expected to

TABLE 2-4
GROSS DEMAND FOR WATER SUPPLY IN MGD
WATER SUB-REGION A, 1960-2020

ITEM	1960	1980	2000	2020
Anthracite Counties				
Lackawanna	44	77	153	260
Luzerne	63	110	220	372
Schuylkill	30	53	105	180
Total	137	240	478	812
Pocono Counties				
Carbon	9	16	30	43
Monroe	7	13	23	35
Pike	2	3	4	6
Wayne	5	8	15	24
Total	23	40	72	108
Total - Sub-region A[a/]	160	280	550	920

[a/] From Appendix D, Water Supply and Water Quality Control, FWPCA; allocated to each county in relation to population and employment shares implied in Appendix E, Economic Base Study.

TABLE 2-5
NET DEMAND FOR WATER SUPPLY IN MGD
WATER SUB-REGION A - 1980-2020

ITEM	1980	2000	2020
Anthracite Counties			
Lackawanna			
Scranton (Water Service Area)	20	70	104
Luzerne			
Wilkes-Barre (Water Service Area)	18	55	92
Hazelton	(8) 1/	(28) 1/	(58) 1/
Schuylkill (Water Service Area)	14	67	139
Pottsville	(7) 1/	(32) 1/	(69) 1/
Total	73 2/	307 2/	635 2/
Pocono Counties			
Carbon	4	17	31
Monroe	3	13	25
Pike	1	3	6
Wayne	2	9	16
Total	10	42	78
Total - Sub-region A	83	349	713

1/ These amounts included in Water Service Area totals in line above.

2/ Columns will not total due to other water use outside growth centers.

increase at a comparable rate but it is expected that manufacturers will develop feasible treatment methods where necessary for supplying their needs from the relatively abundant flows in the major watercourses of the area. Effective pollution abatement programs are needed to parallel industry's efforts if the area is to remain competitively attractive to new (water oriented) industries.

Water Quality

As with flood control and water supply, water quality problems in the two growth areas of the sub-region differ both in type and magnitude. These differences stem from the widely divergent land and water use patterns arising from the exploitation of the natural resources of the two areas. In the following paragraphs, major water quality problems in the two growth areas are discussed. Where analysis of available data permits, residual needs are quantified.

Pocono Counties Stream Pollution. Except for a few tributaries of the Lehigh River rising in the Anthracite fields in northwestern Carbon County and southeastern Luzerne County, the water of the rivers and streams draining the Pocono Counties are of remarkably high quality and are capable of supporting a wide variety of uses. The tributaries of Lehigh River contributing *significant amounts of* mine drainage to the main stem are listed below:

Stream	Tons of Acid/Day	No. Major Discharges (Sources)
Sandy Run	3.0	6
Buck Mountain Creek	0.9	2
Black Creek	2.7	1
Nesquehoning Creek	0.6	2
	6.2	11

Essentially, all of the mine drainage in the Lehigh Basin originates from abandoned mines located on the eastern edge of the Eastern Middle and Southern Anthracite fields. Chemical analysis of mine drainage originating in this area shows it to be relatively low in iron and manganese, but acidity and sulphate concentrations are high. As a result of this mine drainage, the waters in the main stem of Lehigh River are severely degraded as far downstream as Northampton, a distance of some 40 miles. Although no projects for abatement of mine drainage pollution in the Lehigh Basin have been authorized to date, initial studies indicate that benefits to be derived from cleaning up some 40 miles of the Lehigh would probably make an abatement project feasible.

Pocono Counties, Other Pollution Problems. The rate of new residential development in the vicinity of the many lakes and small reservoirs of Wayne, Pike and Monroe Counties is rapidly increasing at present, and is expected to accelerate in the future on completion of the Tocks Island Reservoir and Delaware Water Gap National Recreation Area. Nutrient enrichment (causing algal blooms) and bacterial pollution, due to agricultural runoff and inadequate treatment of municipal wastes, are already causing problems in some of the lakes and ponds in this area. Due to the inestimable value of these scenic water resources as a basis for development of the outdoor recreation industry in this area, the need for preserving them against pollution is of highest priority.

Anthracite Counties, Stream Pollution. The waters of the Susquehanna River -- some 8 billion gallons per day on the average -- enter the Wyoming Valley of Water Sub-region A at West Pittston (in Luzerne County) in relatively pure form. However, from this point, throughout its southwesterly course through the sub-region until it emerges at Berwick, the stream picks up a vast pollution load in the form of untreated municipal wastes from virtually every community in the watershed (including the Lackawanna River Basin). In addition, some 600 tons of acid and 240 tons of iron and manganese are pumped from mines, or drain by gravity from strip mines into the river. Pollution in the Lackawanna River has been aggravated by the low river flows which have prevailed in recent years.

The nature and history of the municipal sewage disposal problem in the Anthracite Counties is similar to that of hundreds of communities throughout the nation which have used flowing streams for natural waste disposal systems in the past. The principal difference appears to be the tardiness of the local governing agencies in adopting effective measures for off-stream treatment. Fortunately, corrective measures, so far as the organic pollution problem is concerned, are well under way in the Three-County area. Though sadly belated, practically all the larger communities in the Wyoming Valley of Lackawanna and Luzerne Counties have now pooled their efforts, and, with considerable aid from State and Federal programs, it is estimated that by 1971 almost 95 percent of the Two-County areas' population will be connected to sewer systems providing at least primary treatment. About 40 percent of this system, mainly in Lackawanna County, where the needs are greatest, will provide both primary and secondary treatment. Similar, though slower, progress in cleaning up municipal wastes is being made in Schuylkill County, where numerous small communities (and a few larger ones) have been dumping untreated sewage into the Schuylkill and Little Schuylkill River systems in the past.

Although the current needs for improving water quality through abatement of pollution from sewage are substantial, it is believed that the machinery is in motion for achieving a complete solution to this long standing problem. However, extreme care on the part of

planning agencies must be exercised to insure that currently planned (and constructed) facilities are adequate to meet future needs.

The tabulation below shows the FWPCA estimate of current (1960) untreated waste loadings in the entire sub-region projected through year 2020. This tabulation is based on the assumption that Benchmark Goals are achieved.

Untreated Waste Loadings (P.E.*/ in 1,000's)
in Water Sub-region A

1960	1980	2000	2020
770	970	1,650	2,650

*/ P.E. = Population Equivalent

Assuming that 90 percent of the untreated wastes are in the Anthracite Counties, and also that current programs will accommodate all needs through 1980, Tables 2-6 and 2-7 below present the estimated untreated and treated waste loadings by year, for the sub-region as a whole, growth areas, and individual counties.

Land Development

Water resource needs related to land development for agricultural, industrial, and outdoor recreational use exist throughout the Water Sub-region. Table 2-8 below gives a breakdown of use for the (approximately) 2,840,000 acres comprising the sub-region, for years 1960 to 1975, and projected to year 2020. For the purposes of this study, it is assumed that acreages dropped from agricultural and mining uses will become available (eventually) for future urban and other types of development.

TABLE 2- 6
UNTREATED WASTE LOADINGS (1000 PE'S)
WATER SUB-REGION A, 1960 - 2020

Item	1960	1980	2000	2020
Anthracite Counties				
Lackawanna	212	266	455	720
Luzerne	303	382	655	1060
Schuylkill	144	182	310	500
Total	659	830	1420	2260
Pocono Counties				
Carbon	43	57	94	160
Monroe	34	42	69	117
Pike	10	11	16	27
Wayne	24	30	51	86
Total	111	140	230	390
Total, Sub-Region A[a/]	770	970	1650	2650

a/ From Appendix D, Water Supply & Water Quality Control, FWPCA, allocated to each county in relation to population & employment shares implied by Appendix E, Economic Base Study.

TABLE 2-7
TREATED WASTE LOADING (1000 PE'S)
WATER SUB-REGION A, 1960 - 2020
(assuming 85% BOD removal)

Item	1960	1980	2000	2020
Anthracite Counties				
Lackawanna	32	40	68	107
Luzerne	45	57	97	158
Schulykill	21	27	47	75
Total	98	124	212	340
Pocono Counties				
Carbon	7	8	15	24
Monroe	5	6	11	17
Pike	1	2	3	4
Wayne	4	5	7	13
Total	17	21	36	58
Total, Sub-Region A[a/]	115	145	248	398

a/ From Appendix D, Water Supply & Water Pollution Control,

TABLE 2-8

LAND USE WATER SUB-REGION A
1960, ESTIMATED 1975 AND PROJECTED
TO 2020 (1,000 ACRES)

Use	1960	1975	2020
Cropland and Pasture	577	417	382
Forest and Woodland	1,930	1,880	1,800
Mining	94	90*/	85*/
Urban and Other	236	450	570 1/

*/ Decrease in mining lands does not correspond to percent decrease in mining activity due to the large percentage of mining lands which are unproductive (spoil and culm banks, abandoned pits, and deep mine workings).

1/ Note that net increase in land becoming available for other than agricultural use (1960 to 2020) is 334,000 acres.

As shown in Table 2-9, estimates prepared for the Commonwealth of Pennsylvania by the U.S. Department of Agriculture, Economic Research Service, Forest Service, and Soil Conservation Service, indicate that in order to maintain present levels of productivity relative to population, 85 percent of the total acreage available for agriculture in the sub-region in 1975 will require conservation treatment measures of some type -- erosion control, management of excess water, improvement of vegetative cover for all land use.

TABLE 2-9

CONSERVATION TREATMENT NEEDS FOR
WATER SUB-REGION A
(1,000 ACRES)

Conservation Treatment Needs For	Total Area Available (1965)	Area Needing Treatment and Feasible to Treat	Percent Requiring Treatment
Cropland	298	189	64
Pasture	120	85	71
Forest and Woodlands	1,879	1,879	100
Other Agricultural	161	16	10
TOTAL	2,458	2,169	85

Of the 189,000 acres of cropland requiring treatment, almost 87 percent is for erosion control. About 75 percent of pasture land treatment is for improvement of vegetative cover. For forest and woodlands needing treatment, about 69 percent require hydrologic stand improvement.

As a result of investigations carried out under the Appalachian Water Resources Study, the U.S. Department of Agriculture, Soil Conservation Service, has found that there is an urgent need for an accelerated land treatment program over the next 10 years to insure that land productivity will be sufficient to meet the demands of a constantly increasing population from a constantly decreasing acreage. A summary of needs and estimated installation costs for Sub-region A are given in Table 2-10. See Appendix A, Agriculture, Forestry, and Conservation, for further details.

TABLE 2-10
WATER SUB-REGION A
RECOMMENDED ACCELERATED LAND TREATMENT
MEASURES AND INSTALLATION COSTS FOR
10 YEAR PERIOD

Measure	Units	No.	Costs ($)
Cropland	Acres	640	14,870
Grassland			
Improvement	Acres	7,080	86,020
Establishment	Acres	2,830	34,380
Critical Area Stabilization			
Roadbank	Acres	410	143,500
Surface-Mined Area	Acres	50,100	5,010,000
Recreation and Wildlife			
Farm Ponds	No.	22	8,600
Fish Pond Management	No.	70	4,540
Planting	Acres	920	184,000
Recreation Access Roads	Miles	57	1,040,440
Wildlife Habitat Development	Acres	9,010	648,720
Wildlife Habitat Preservation	Acres	52,410	104,820
Picnic Areas	Acres	2,080	3,224,480
Camping Areas	Acres	800	4,003,710
Private Forest and Woodland			
Tree Planting	Acres	3,000	165,000
Erosion Control	Acres	120	2,400
Harvest Cutting	Acres	1,800	16,200
Hydrologic Stand Improvement	Acres	6,800	163,200
Woodland Grazing Control	Acres	1,800	7,500
Management Plans	No.	450	67,200
Soil Surveys	Acres	--	--
Basic Conservation Plans	No.	2,060	490,000
TOTAL INSTALLATION COSTS			**15,419,580**

Industrial and Residential Development. Table 2-11 shows acreage in Urban Development in Sub-region A in 1960, and projected needs by year 2020, assuming that Benchmark Development goals are achieved. Present (1960) use and projected requirements of the two growth areas for residential and industrial use are broken out separately.

As indicated in the table, the total increase in land requirements for urban development in the sub-region by year 2020 is estimated to be 85,000 acres, 76,000 of which will be required in the Anthracite growth area. Referring to the land use projections in Table 2-8, it was noted that some 334,000 acres are expected to be retired from agricultural and mining uses in the sub-region by year 2020. Presumably, most of these lands could be absorbed into urban development as the needs increased, and, on the surface no scarcity of developable land is indicated. The future need for developable urban land becomes more critical when viewed from the standpoint that industrial sites, offering the availability of high quality (self-supplied) surface water, are already scarce in traditionally industrial Lackawanna, Luzerne, and Schuylkill Counties. This condition is primarily the result of previous indiscriminate mining practices that resulted in mutilation of vast tracts of potentially valuable lands, and pollution of surrounding water courses with mine acid and sediment. Figure 2-15 shows the relative locations of Anthracite fields, and state parks in the Sub-region, and Table 2-12 shows the extent to which the urban area within the coal fields has been disturbed by mining operation. It also shows the estimated additional acreage required for expansion of the manufacturing industry and residential development, if the growth area is to achieve its developmental benchmarks.

Recreation

Studies by the Department of Interior's Bureau of Outdoor Recreation*/ indicate a large existing demand for outdoor recreational facilities

---

*/ Results of BOR's study are reported in Recreation and Aesthetics, Appendix F to the Appalachia Water Resources Survey.

TABLE 2-11

AREA IN URBAN LAND USE
(1,000 acres)
WATER SUB-REGION "A"

Year	Anthracite Counties		Pocono Counties		Total[b]
	Residential	Industrial & Commercial	Residential[a]	Industrial & Commercial	
1960	50	10	9	2	71
2020	114	22	16	4	156
Change	64	12	7	2	85

a/ Excludes summer home development induced by Tocks Island Reservoir and Delaware Water Gap National Recreation Area.

b/ Total land area designated in urban land use in 1960 was 234,000 acres. Therefore uses other than residential, commercial and industrial accounted for 163,000 acres.

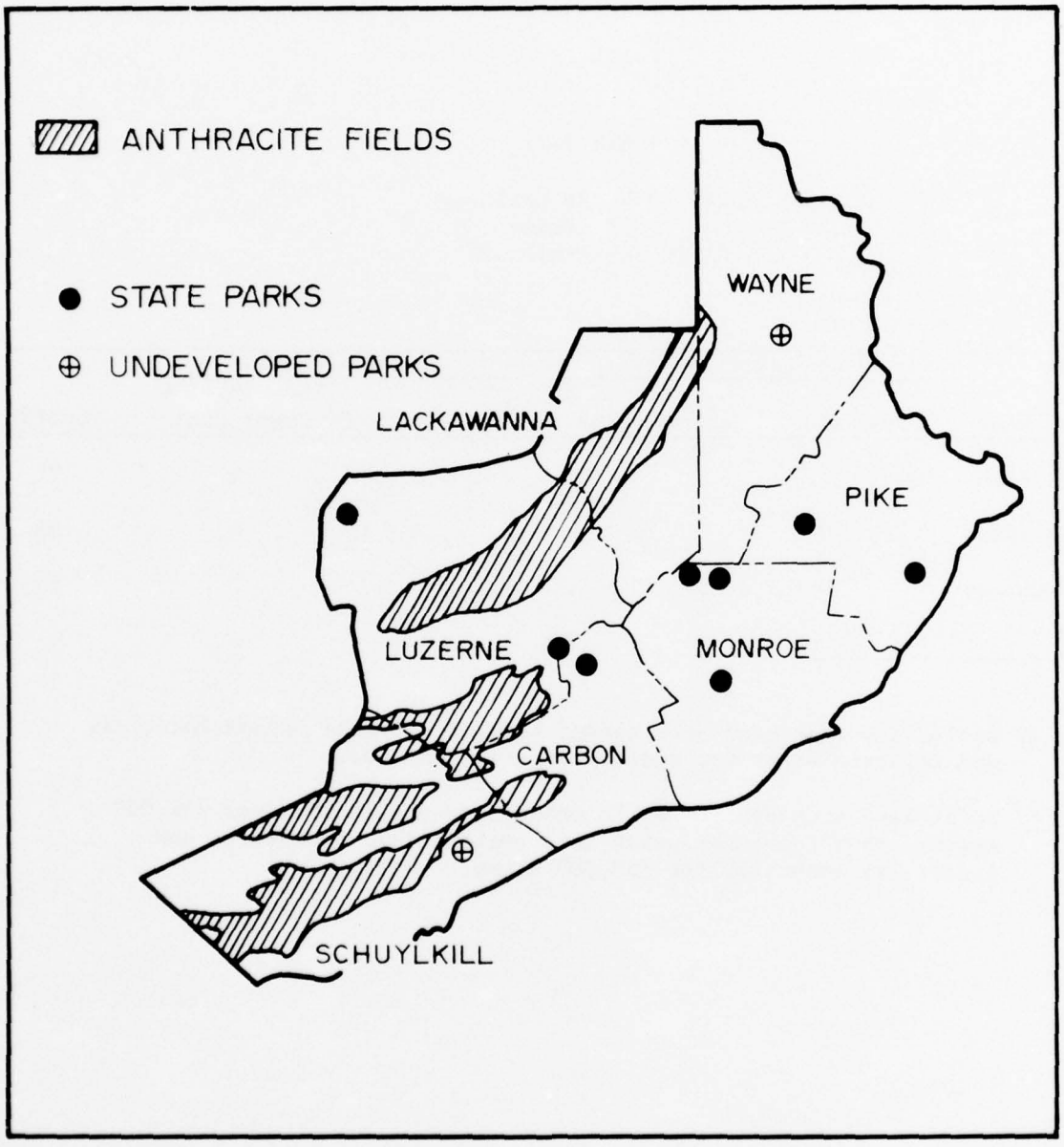


Figure 2-15 Location of Anthracite Fields and State Parks.

TABLE 2-12

URBAN AREAS IN THE ANTHRACITE FIELDS, AREAS DISTURBED BY MINING, AND ACREAGE REQUIRED FOR EXPANSION OF MANUFACTURING INDUSTRY AND RESIDENTIAL AREAS BY YEAR 2020

County (Major Urban Centers) 1960 Population over 10,000	Total Urban Area in Coal Fields (acres)	Urban Area Disturbed by Mining */ (acres)	(%)	Additional Acreage Required to Meet Benchmark Development by 2020 (Industrial)	(Residential)
Lackawanna	50,200	10,300	20	1,950	28,230
Carbondale	2,100	700	32	N/A	2,000
Dunmore	5,472	600	11	N/A	3,110
Scranton	13,100	1,700	13	N/A	13,200
Luzerne	20,800	2,600	13	2,830	32,670
Hazelton	3,800	800	20	N/A	4,000
Kingston	1,400	30	2	N/A	2,800
Nanticoke	2,300	300	14	N/A	2,000
Pittston	1,200	100	9	N/A	1,800
Plymouth	800	80	10	N/A	1,500
Wilkes-Barre	4,700	400	9	N/A	7,300
Schuylkill	8,100	2,100	25	1,400	15,660
Pottsville	2,300	200	8	N/A	2,900
Shenandoah	1,000	700	70	N/A	1,600
Tamaqua	900	350	37	N/A	1,600
Three-County Total	79,100	15,000	19	6,180	76,560

***/ Includes all lands disturbed by mining - active and abandoned.**

N/A - Not Available

Source: Mine Disturbed Areas from
U. S. Department of Agriculture
Forest Service
Northeastern Forest Exp. Station
Upper Darby, Pa.

particulaly water-oriented) in the area. If the water sub-region attains its Benchmark goals this demand is expected to grow at an accelerated rate, and by year 2020 the total demand for outdoor recreation facilities of all types will be almost ten times as great as it was in 1966. Figure 2-16 below is a graphic representation of the relationship between supply, demand and needs for four types of outdoor recreational activity in the sub-region, estimated for 1966 and projected to year 2020; total demand (all types of activity) is also indicated.

It should be noted that these projected demands, which are based on residential population growth, will be concentrated primarily in the Anthracite Counties where there is a scarcity of existing facilities. These demands will exist despite the existing facilities in the nearby Pocono Counties and the future completion of the Delaware Water Gap National Recreation Area which will be heavily used by persons from the metropolitan areas outside the sub-region.

It is interesting to note that existing public facilities are considered adequate to fulfill current demands for boating, picnicking and camping facilities, but for swimming, demand already is over three times as great as supply. By 1980, demand is expected to exceed supply in all acitivities except camping, and by 2020 demand will exceed supply in all activities by the following ratios:

Boating	-	8 to 1
Swimming	-	30 to 1
Picnicking	-	9 to 1
Camping	-	2 to 1
Total (4 Activities)	-	13 to 1

The formidable increases portrayed by the excess of needs over supply indicate the importance of emphasizing water related recreation in present and future water resource development. A greater intensity of the use, from more extensive development around reservoirs and by increasing the day load during the week will accommodate many of those wishing to participate in water related outdoor recreation opportunities.

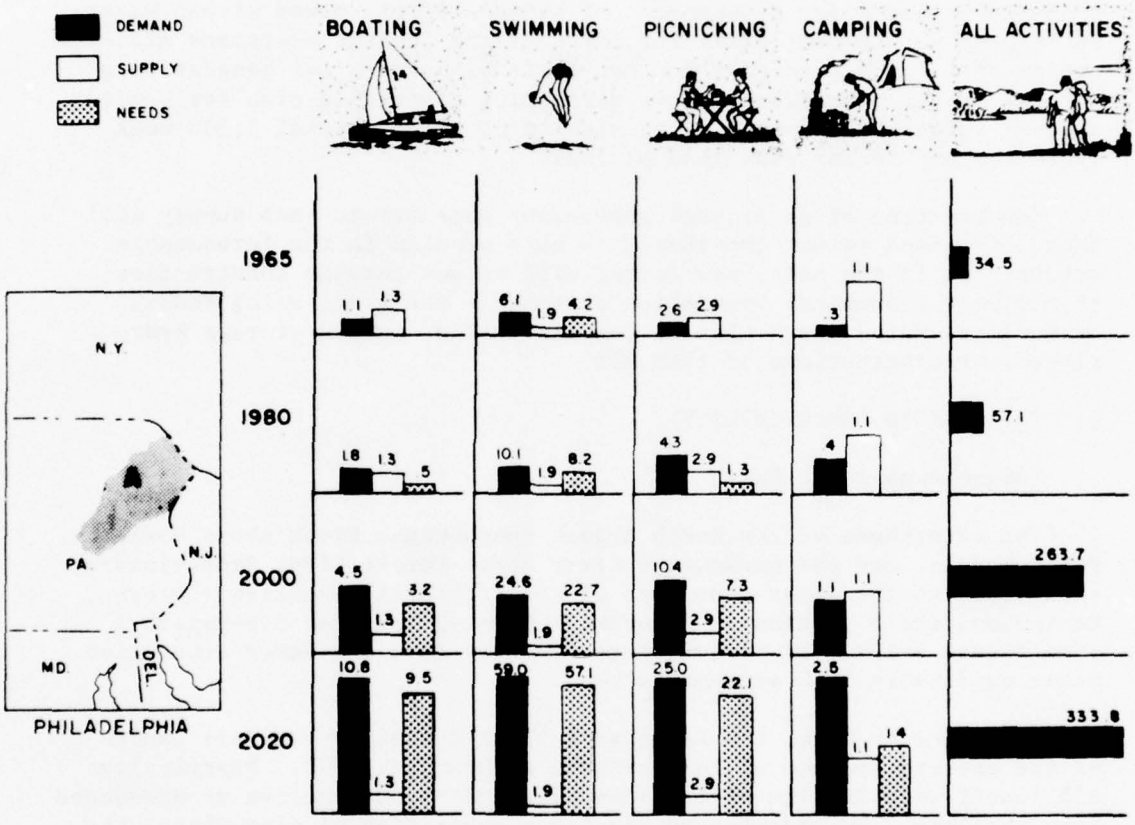
Careful exploitation of the growing market for recreation by both private and public sectors will be necessary both to accommodate needs and to increase incomes.

Power

Water Sub-region A lies wholly within the Federal Power Commission's Power Supply Area No. 5. The major electric power supplier for this area is the Pennsylvania-New Jersey-Maryland Interconnected System (PJM), which supplies power to about 75 percent of Pennsylvania, over half of New Jersey, all of Delaware and about two-thirds of Maryland. This vast complex is served by 16 major utilities companies whose installed capacity

FIGURE 2-16 **APPALACHIA SUBREGION** A

ANNUAL ACTIVITY DAYS (MILLIONS)



SOURCE: Appendix F, Recreation and Aesthetics, BOR.

in 1967 was almost 22,000 mega watts. A discussion concerning electric power needs, probable future installation of generating capacity, and cooling water needs for the Appalachian Region, on a regional basis, is contained in Chapter 4 of Part I.

With the exception of Tocks Island Dam and Reservoir, there are no proposed projects for development of hydro-electric power within Water Sub-region A. Current plans for Tocks Island include a storage allocation of 410,000 acre-feet for conventional hydro-power generation of 46 mega watts. Consideration is also being given to a plan for pumped storage which would result in generation of an additional 1,300 mega watts for use during peak load periods.

Construction of additional generating capacity to keep supply well ahead of demand is not considered to be a problem in the foreseeable future. As in the past, new demand will be met through construction of the most economical generation system for the area, using fossil or nuclear-fueled steam plants, conventional or pumped storage hydro plants, or combinations of them all.

6. INTER-BASIN COMPATIBILITY

Susquehanna River Basin

The watersheds of the North Branch Susquehanna River above Moreland, Pennsylvania, and the Lackawanna River above Forest City, Pennsylvania, contribute to the water resources of the Anthracite Counties (Luzerne, Lackawanna and a portion of Schuylkill County) in Water Sub-region A (See Figure 2-17). At their points of entry into the Water Sub-region, water quality in both streams is good.

Below Forest City, the Lackawanna River traverses the full length of the eastern portion of the northern anthracite field. Practically all runoff reaching the river flows over and through active or abandoned mine workings. In addition to the large quantities of mine waste, the Lackawanna River picks up varying amounts of raw sewage and untreated industrial waste from population centers between Carbondale and Scranton. Beyond Scranton, it empties into the Susquehanna River at Pittston.

The Susquehanna, from a few miles below its point of entrance into the Water Sub-region, courses through the western portion of the northern Anthracite field. As with the Lackawanna River, practically all tributaries are highly polluted with mine and industrial wastes or sewage.

The two river systems provide a relatively abundant quantity of water. Because of its very poor quality, however, it is of little value as a source of supply for municipal or industrial use. It is also of little value in the development of badly needed water-oriented outdoor recreation facilities. Its value to downstream users, outside of Water Sub-region A, is similarly affected.

In the Susquehanna River Basin area of the Water Sub-region, there is no significant effect on the flow regimen of the main stream due to reservoirs. Minor modification of the flows of the Lackawanna River is attributable to Stillwater Reservoir which is located in Water Sub-region B, and controls runoff from about 10 percent of the river's drainage basin.

Delaware River Basin

The Delaware River, which forms the northeastern boundary of Water Sub-region A, receives the flows of the Lackawaxen, Lehigh and Schuylkill Rivers. The latter, in turn, drain the eastern portion of Water Sub-region A. The waters of the Lackawaxen system, and all the lesser tributaries of the Delaware in the Pocono Counties, are generally of excellent quality. Lehigh River headwaters recieve some acid mine drainage from the middle Anthracite field in Carbon County. Although this acid drainage has resulted in destruction of fish and aquatic life in the upper reaches of the Lehigh, alkaline waters entering the main stem downstream from Jim Thorpe neutralize the acid and the quality of the water emerging from Water Sub-region A is not drastically lowered.

With the exception of the upper reach of the Lehigh River, fish and wildlife thrive in all these watersheds. With continuing implementation of pollution control measures, outdoor recreation opportunities are being progressively developed in the area.

The Schuylkill and Little Schuylkill Rivers above Port Clinton are highly polluted by acid mine drainage and sediment (culm and coal washings) from the southern Anthracite fields. The degree of acid pollution is alleviated downstream through dilution of main stem waters by tributaries carrying calcium carbonate. The headwater streams, in their present condition, are practically useless as sources of water supply, or for outdoor recreation. Further downstream, the industrial centers beyond the Appalachian Region must employ expensive treatment processes in order to use main stem waters. Periodic maintenance dredging is required to keep the main stem free from culm deposits.

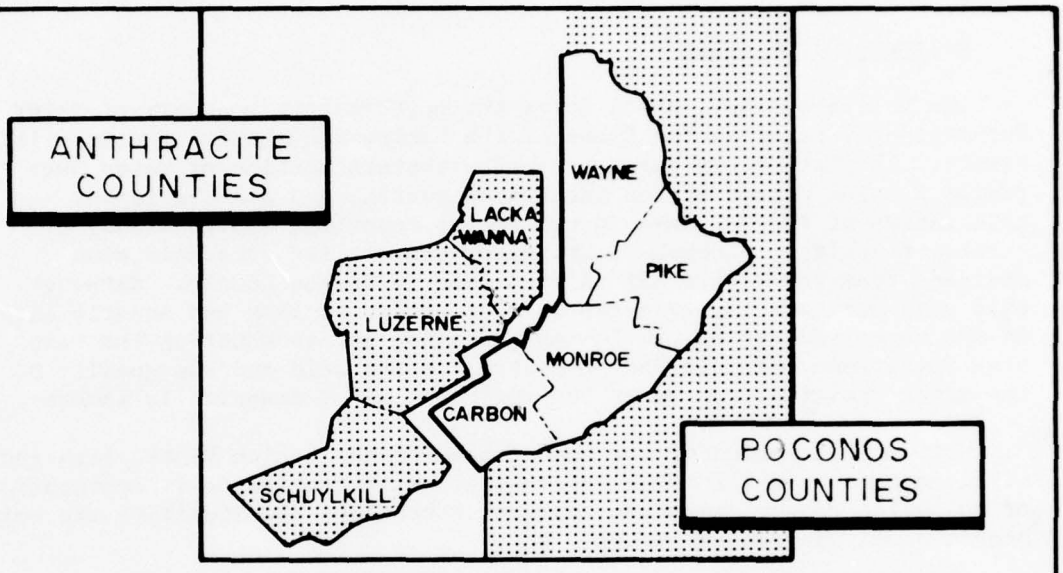
In contrast to the Susquehanna Basin, flows in the Delaware River and its larger tributaries are modified by several major reservoir impoundments. Storage allocated to flood control in Prompton, General Edgar Jadwin, and Francis E. Walter Reservoirs is about 153,000 acre-feet. Pepacton,*/ Cannonsville,*/ and Neversink*/ Reservoirs have over 840,000 acre-feet of storage dedicated to water supply for the New York City area and compensation release purposes in the Delaware Basin. Lake Wallenpaupack Reservoir provides over 158,000 acre-feet of usable capacity for hydro-electric power generation. In some instances, all of these impoundments have substantially reduced flood discharges.

---

*/ Outside of Water Sub-region A.

Summary of Water Related Needs

Figure 2-17 below is a graphic summary of the major water related needs existing in the Susquehanna and Delaware River Basins, while quantitative estimates are presented in Table 2-13.



	FLOOD DAMAGE PREVENTION	LAND DEVELOPMENT	WATER SUPPLIES	RECREATION
ANTHRACITE COUNTIES	MAINLY URBAN	MAINLY INDUSTRIAL AND RECREATIONAL	QUANTITY: FUTURE SHORTAGES INDICATED QUALITY: MORE IMPROVEMENT NEEDED	MAX. DEVELOPMENT OF LOCAL FEATURES
POCONO COUNTIES	MAINLY RURAL	MAINLY RURAL AND FOR OUTDOOR RECREATION	QUANTITY: NO PROBLEM QUALITY: MAINTAIN EXISTING	MAX. DEVELOPMENT OF NATURAL POTENTIAL

Figure 2-17 Water Resources Needs

TABLE 2-13

SUMMARY OF WATER RELATED NEEDS
WATER SUB-REGION "A"

Growth Area/Growth Center	1980 Flooding Damages 1/ Annual ($1,000)	2020 Water Supply (MGD)	2020 Water Quality Control (if by dilution)	2020 Land Development (Ind.& Comm.) (acres)	2020 Recreation Days 1,000
Anthracite Counties					
Scranton	314	104	73 cfs	3,800	
Wilkes-Barre	666	92	-	4,400	
Hazelton	-	16	31 cfs	1,100	
Pottsville	-	69	125 cfs	1,400	
Total Anthracite Counties	1,494	635	N/A	12,000	
Pocono Counties					
Carbon					
Jim Thorp-Lehighton	9	31	36 cfs	170	
Monroe					
Stroudsburg-E.Stroudsburg	78	25	161 cfs	170	
Pike					
Wayne					
Honesdale	83	16	34 cfs	90	
Total Pocono Counties	1,041	78	N/A	2,000	
Total Sub-Region "A"	2,535	713	N/A	14,000	60,000

1/ Residual damages by 1980 in terms of 1968 value and development.

SECTION III - ALTERNATIVES FOR MEETING NEEDS

7. STRUCTURAL

Structural alternatives have been selected from an array of Federal, State and private water resource development opportunity. Consideration and provisions of flood protection include storage of flood flows and impoundments and levees, floodwalls, channel improvements, and combinations of these. Alternatives for provision of water supply considered both surface and ground water sources, upstream impoundments, and diversion from other streams. Water quality improvements would be accomplished by the most advantageous means, whether by dilution or by higher degree of treatment of effluent. The relevant structural alternatives are discussed below.

Anthracite Counties

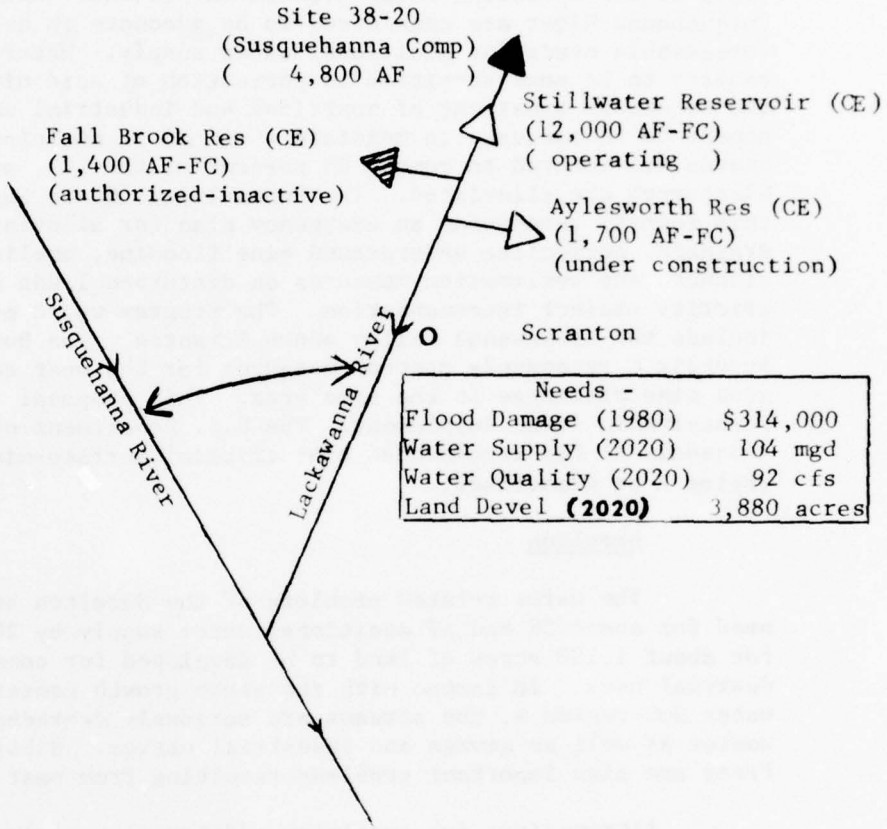
There are four growth centers located within the Anthracite Counties of Sub-region A, of which Scranton, Wilkes-Barre, and Hazelton are classified as primary growth centers. The remaining growth center, Pottsville, is classified as secondary.

Scranton

Flooding damages to the Scranton Growth Center from the Lackawanna River in 1980 are estimated to equal about $314,000 annually (in 1968 dollars). A source for about 204 mgd of additonal water supply will be needed by 2020 and maintenance of water quality standards of 4 ppm DO would require an augmentation of about 350 cfs or additonal advanced waste treatment. Land development needs for commercial and industrial development are estimated to be 3,800 acres in the growth center. The entire Lackawanna River mainstem is significantly affected affected by acid mine drainage, either intermittently or continuously.

Alternatives for flood damage reduction at Scranton include the potential Fall Brook Reservoir (authorized CE), a site on a tributary of Fall Brook Creek considered by the U.S. Soil Conservation Service in the Susquehanna Comprehensive Survey, extension of local protection and flood plain management, none of which are mutually exclusive alternatives. The Soil Conservation Service site on Fall Brook Creek could be developed to yield about 9 mgd for water supply or an additional supply could be provided by pipeline diversion from the Susquehanna River. Information contained in Appendix H indicates ground water costs would range from $.05 to $0.25 per 1,000 gallons delivered to the well head, and that ground water yields are relatively poorer in this northwestern portion of Sub-region A. Control of acid mine discharge along with land reclamation measures would improve the usefulness of natural stream flows originating in the region for water supply, recreation and waste disposal

uses. Substantial additional developmental potential of the flood plain for industrial and commercial uses is not considered to be as effective as reclamation of disturbed lands left from previous mining activities.



Wilkes-Barre

Average annual flooding damages in the Wilkes-Barre Growth Center, including the Kingston and Edwardsville areas, is estimated to be about $666,000 in 1980. These damages reflect 1967 values and level of development. It is estimated that an additional 234 mgd of water supply would need to be developed, but the mainstem of the Susquehanna would be an adequate source if water quality standards, including reduction of acid mine drainage, can be implemented. Land development needs for commercial and industrial areas would total about 4,400 acres by 2020.

The acid mine drainage problem in the Wilkes-Barre area is seriously complicated by underground flooding; mine subsidence and mine fires are also important problems.

Alternative means for reducing flooding damages at the Wilkes-Barre growth center include upstream flood control reservoirs and additions to the operating local protection project. Natural flows in the Susquehanna River are considered to be adequate in quantity to meet the foreseeable needs for additional water supply. Water quality management appears to be most sensitive to correction of acid mine discharge and to the secondary treatment of municipal and industrial wastes. Natural flows appear to be adequate to maintain 4 ppm DO if municipal and industrial wastes are treated to remove 85 percent of the BOD, and if acid mine discharges are alleviated. The Pennsylvania State Supplement (Part V of this report) recommends an emergency plan for alleviating acid mine drainage, correcting underground mine flooding, ameliorating mine subsidence, and reclamation measures on disturbed lands as their first priority project recommendation. The program would extend upstream to include the Lackawanna Valley above Scranton. The Bureau of Mines in Appendix C recommends control measures for the most serious causes of acid mine discharge in the same area. This proposal is contained in the Pennsylvania State Supplement. The U.S. Department of Agriculture (Appendix A) has recommended that critical surface-mined area in Sub-region A be stabilized.

Hazelton

The water related problems of the Hazelton area include the need for about 58 mgd of additional water supply by 2020 and the need for about 1,100 acres of land to be developed for commercial and industrial uses. In common with the other growth centers in this part of water Sub-region A, the streams are seriously degraded by acid mine wastes as well as sewage and industrial wastes. Subsidence and mine fires are also important problems resulting from past mining.

Alternatives for supplying additional municipal and industrial water include ground water sources, additional small impoundments or pipeline diversion from larger streams. Disturbed mined areas can be reclaimed to provide the needed commercial and industrial land. Water quality management will depend upon control of mine drainage, additional treatment of municipal and industrial wastes and supplemental flow augmentation.

Pottsville

The most serious water related problems at Pottsville are the maintenance of water quality and the need to increase supplies of water, to 69 mgd by 2020. Water quality measures, either from augmentation at about 125 cfs or advanced waste treatment, will be required to maintain

minimum standards. Land development needs for commercial and industrial uses are estimated to be 1,400 acres. Pottsville is located in an Anthracite area with a long history of mining. All streams in the area are continuously polluted from mine drainage. Industrial waste and municipal sewage also contribute to the reduced water quality.

Alternative measures for additional water supply appear to be upstream impoundments and ground water. Upstream impoundments could also meet a part of the needs for flow augmentation. Reclamation of disturbed land areas should provide an effective alternative for meeting land development needs for commercial and industrial uses.

Pocono Counties

Because of the low population concentration water related problems in the Pocono Counties are of less importance when compared to the Anthracite Counties' problems. Future projections indicate a maintenance of this conditionn. However, the location of the Poconos vis-a-vis New York City, Philadelphia, and Trenton indicates the pressure for recreational use of the scenic area. Heavy demands for diversion of Delaware River flows to the New York City area is historical. The lower river is subjected to heavy water supply withdrawals for the urban centers located nearby and waste loads which are discharged to the river are high. Development of the Tocks Island Reservoir and the Delaware Water Gap National Recreation Area will attract increased recreational use of the area and should stimulate vacation home building activity. The subsequent effects of this development on water supply and pollution control problems is of immediate concern to those individuals and agencies involved in regional planning for the Poconos area.

Flooding in the Pocono Counties is estimated to cause about $476,000 worth of annual damages in terms of 1968 development and dollars by 1980. It is anticipated that 78 mgd of additional water supply may be needed in the area by 2020. Additional land development for commercial and industrial purposes is estimated to be about 2,000 acres by 2020.

The Poconos Growth Area contains the Stroudsburg-East Stroudsburg growth center designated as a primary growth center and the Lehighton-Jim Thorpe and Honesdale secondary growth centers.

Stroudsburg-East Stroudsburg

Flooding damages in this growth center are estimated to be at the rate of about $78,000 annually by 1980; additional water supply needs are estimated to be 25 mgd by 2020; additional land development for commercial and industrial uses is estimated to be 170 acres by 2020 and the need for additional flow augmentation is expected to reach 161 cfs by 2020. The need for additional flow augmentation could be significantly lowered by provision of advanced waste treatment.

Completion of USDA upstream watershed projects on Lower Brodhead and Pocono Creek Watersheds which include 21 of the 26 small control structures recommended in the Delaware River Comprehensive Basin Study could reduce flooding damages in the Stroudsburg areas to about $43,500 annually. Upstream impoundments, groundwater or probably the Tocks Island Reservoir could furnish needed water supply. The magnitude of flow augmentation needs as compared to available drainage area above the growth center will, in all probability, require the utilization of advanced waste treatment measures to maintain water quality. There are no apparent constraints on the availability of adequate land.

Jim Thorpe-Lehighton

Flooding damages are expected to be reduced to about $32,000 annually by 1980. An additional 25 mgd of water supply may be needed by 2020, while the need for additional flow augmentation is estimated to be 36 cfs by then. Land development needs are estimated to be 170 acres for industrial and commercial uses by 2020.

The Mauch Chunk Creek Upstream Watershed project which includes one of the small flood control structures recommended in the Delaware River Basin Comprehensive Report will reduce flooding damages to about $9,000 annually. The project could afford a limited amount of supply or ground water sources could be developed. Water quality standards could be maintained by advanced waste treatment or by flow augmentation. There are no significant barriers to the development of needed land for development of commercial and industrial uses.

Honesdale

Flooding damages are estimated to be $83,000 annually by 1980. About 16 mgd of additional water supply will be needed by 2020 and about 34 cfs of additional flow augmentation on the Lackawaxen River. Needs for additional land development for industrial and commercial uses are estimated to be 90 acres by 2020.

Additional water supply should be available from the modification of Prompton Reservoir or from groundwater sources. Minimum and water supply releases from Prompton Reservoir should alleviate the water quality problems. There are no formidable constraints to land development in the area.

Other Needs

The needs for recreation, power and conservation practice are less amendable to specific delineation by growth area. The previous discussion on the sub-regional area is considered to be appropriate and adequate to define these needs.

Alternatives for meeting the anticipated and additional recreational needs will include provision of new water and land development and the rejuvenation of operating projects with the view of accommodating additional visitors and uses. As previously stated, it is believed that the potential for additional conventional hydroelectric power is quite limited (after construction of the Tocks Island Reservoir). However, pumped storage hydroelectric power may be developed in some situations where the incidence of load centers and favorable topography coincide.

8. NON-STRUCTURAL

The occurrence of over $1.4 million of annual flooding damages in Water Sub-region A, remaining after all structural measures assumed to be in place and all structural alternatives considered in the plan, indicates the necessity for increased emphasis on non-structural measures for reducing the magnitude of flood damages. Executive Order 11296, the National Flood Insurance Act of 1968, and flood plain information studies offer the means for implementing flood plain management practices which lead to more effective land-use policies for the flood plains. Alert action based on sound hydrologic and hydraulic studies can guide the developmental potential, minimize the unwitting encroachment into areas of high risk flooding hazards, and promote wise land-use policies.

Non-structural means for minimizing water quality and quantity problems are important components of any effective water management plan. The combined Federal and State program for establishing and controlling water quality standards, including enforcement of Pennsylvania's clean streams and mining laws, will contribute to the wise use of this resource. Technological improvements and treatment systems, and re-use or close cycle processes in industrial plants, and other application promise gains for both quality and quantity problems.

These and other relevant non-structural alternatives have been carefully considered in the development of the comprehensive water resource plan.

SECTION IV - EVOLUTION OF THE SUB-REGION WATER RESOURCES DEVELOPMENT PLAN

9. SELECTION OF BEST SOLUTIONS

Water resource needs for the growth centers in Sub-region A have been described in Section II and probable sources for meeting these needs are described in Section III. Existing authorized and potential projects, whether developed by the Corps of Engineers, Department of Agriculture, State or public utility, have been considered. Non-structural alternatives have also been given consideration in the derivation of this plan.

Available cost data are, in many instances, only precise enough to indicate the approximate range. They are considered adequate to indicate comparative advantages only.

Anthracite Counties

Derivation of the plan will include the specific problems of the Scranton, Wilkes-Barre, Hazelton, and Pottsville growth centers independently and a separate discussion of the general problems regarding correction of acid mine discharge and the other problems stemming from current and past mining (see Figure 2-18).

Scranton

Estimated needs at Scranton include:

Reduction of Flooding Damages (1980)	**$314,000**
Water Supply (2020)	204 mgd
Water Quality (2020)	350 cfs
Land Development (2020)	3,800 acres

Available alternatives include:

1. Flood Control (Needs - $314,000)	Damage Reduction	Est. Annual Costs
Fall Brook Reservoir (authorized CE)	-	-
SCS Site on Lackawanna River (37-20)	$59,000	
Expand LPP at Scranton	NA	NA
Flood Plain Management	NA	NA

2. Water Supply (Needs - 104 mgd)	Yield	Est. Annual Costs
SCS Site on Lackawanna River (37-20)	6 mgd	NA
Diversion from Susquehanna River	118 mgd	$ 1.6 million
Ground Water (would require from 465 to 4,650 acres well field)	118 mgd	$ 2.1 - 10.8 million

3. Water Quality (needs - 73 cfs)		
SCS Site on Lackawanna River	9 cfs	
Diversion from Susquehanna River	73 cfs	$645,000
Advanced Waste Treatment	(73 cfs)	$157,000

The most effective means for reducing flooding damages appears to be from expansion of the local protection project at Scranton and from accelerated floodplain management practices. Neither of the upstream sites appear to offer any substantial impact on the flooding problem.

Diversion of water from the Susquehanna River for water supply at Scranton appears to be the most satisfactory means for meeting the need, since ground water and upstream surface storage appears to be much more expensive at the anticipated scale of needs.

Advanced waste treatment would appear to be the most practical and economical means for reducing the organic pollution of the Luckawanna from municipal and industrial wastes. **Reduction and treatment of acid mine discharge will also need to be accomplished to allow water quality standards to be met.**

Reclamation of disturbed mine areas should provide the required additional land for industrial and commercial uses.

Wilkes-Barre

Estimated needs at Wilkes-Barre include:

Flooding Damages (1980)	$666,000
Water Supply (2020)	92 mgd
Land Development (2020)	4,400 acres

Alternatives for meeting the needs include the following:

1. Flood Control (Needs - $666,000)	Damage Reduction	Est. Annual Costs
Local Protection at Wilkes-Barre and Kingston	$377,000	$ 60,000
Upstream Alternatives studied in the Susquehanna Comprehensive	NA	NA
Flood Plain Management	NA	NA

2. Water Supply (Needs - 92 mgd)

Natural stream flow is adequate if quality standards are met.

3. Land Development

Reclamation of mine disturbed lands, correction and prevention and subsidence, and flood protection from mine water pools and catchments in abandoned mines.

Increased local protection has been studied in the Susquehanna Comprehensive Survey and appears favorable. Various upstream storage alternatives studied will also reduce flooding at the growth center although the benefits are more widespread.

Correction of acid mine discharge and provision of secondary treatment of the municipal and industrial wastes would maintain water quality standards and provide a more than adequate source of water supply from the Susquehanna River.

Reclamation of the disturbed lands should provide an adequate source of land for commercial and industrial development at the growth center.

Hazelton

Water needs of the Hazelton growth center include:

Water Supply (2020)	16 mgd
Water Quality (2020)	31 cfs
Land Development (2020)	1,100 acres

Alternatives for meeting these needs include:

1. Water Supply (Needs - 16 mgd)	Yield	Est. Annual Costs
Ground Water	16 mgd	$330,000
Upstream Reservoirs	16 mgd	(Very limited possibilities)
2. Water Quality (Needs - 31 cfs)		
Dilution from Upstream Reservoirs	31 cfs	(Very limited possibility)
Advanced Waste Treatment	(31 cfs)	$400,000

3. Land Development

Reclamation of mine disturbed lands.

Since Hazelton is located along a divide between the Susquehanna and Delaware Basin, provision for additional water supply and dilution water from surface impoundments appears to be limited. Ground water yields are much higher and cost lower than is typical for the northwestern section of Sub-region A, leading to selection of ground water sources as the best alternative for water supply. For similar reasons, advanced waste treatment is considered to be the most effective means for maintaining water quality standards related to organic pollution. Additional measures will be required to reduce acid mine discharge in the streams of the area.

Mine disturbed areas offer a potential source of additional industrial and commercial land.

Pottsville

Water needs at Pottsville include:

Water Supply (2020)	69 mgd
Water Quality (2020)	125 cfs
Land Development (2020)	1,400 acres

Alternatives for meeting these needs include:

	Yield	Est. Annual Costs
1. Water Supply (Needs - 69 mgd)		
Upstream Impoundments	69 mgd	$650,000 - $1,300,000
Ground Water	69 mgd	$1.2 - 6.0 million
2. Water Quality (Needs 125 cfs)		
Upstream Impoundments	125 cfs	$750,000 - $1,500,000
Advanced Waste Treatment	(125 cfs)	$400,000 annually
3. Land Development (Needs - 1400 acres)		
Reclamation of mine disturbed lands		

The water supply needs of Pottsville are likely to be met most efficiently from ground water sources, while advanced waste treatment appears to be the most efficient means for maintaining water quality standards. Abandoned culm piles, in addition to mined areas adversely affect the channel capacity of streams in the Upper Schuylkill Basin from sediment deposition and the erosion process opens new sources of

acid leaching into the streams. Reclamation measures could provide additional land for commercial and industrial needs while reducing sedimentation and acid loads of the affected streams.

Acid Mine Drainage, Subsidence and Mine Flooding

The incidence of serious acid mine discharge combined with underground flooding and subsidence is the most serious environmental factor affecting the Lackawanna and Wyoming Valleys of the Susquehanna River. The cessation of pumping, which has accompanied closing of Anthracite mines in the Lackawanna and Wyoming Valleys, is creating crises conditions as mines fill with water and threaten to flood low-lying sections of the Wilkes-Barre, Hanover Township, Jenkins Township, Pittston Township, Kingston and Edwardsville. In addition to flooding, subsidence is a serious hazard as mines fill and raise the water table to the level of some basements.

During the period 1940 to 1960, the acid load of the river doubled although total flow remained about the same. Thus, the pollution problem grew worse, a condition that has occurred along with the closing of mines in both the Lackawanna and Wyoming Valleys. Changes in mine activity and mine drainage discharges points have greatly altered the quality of the Lackawanna River within the past ten years. Prior to 1960, extensive mining with associated mine drainage severely degraded stream quality. Shifting demand for anthracite coal, the high cost of pumping out high volumes of water encountered, and other circumstances, gradually forced the abandonment of most of the deep mines in the watershed.

Cessation of mining and mine water pumping resulted in a very significant increase in stream alkalinity although some mine drainage influence on the stream quality persisted. However, in January 1961, the mine water pools which had been developing in the abandoned underground workings broke through the surface in the form of a gravity discharge to the Lackawanna River at Duryea, approximately two miles from its mouth, and stream quality downstream was again adversely affected. At present, the largest discharge of mine drainage in the anthracite field is the combination of the Duryea gravity discharge and the discharge from a bore hole, which was subsequently drilled one mile upstream at Old Forge in order to stabilize the level of the underground pools. The combined discharges contribute an average of about 58 mgd, and an acid load of approximately 66 tons per day of net acidity and an iron load of approximately 31 tons per day. Although most of the mine water developed in the Lackawanna River watershed discharges to the river through the Duryea and Old Forge discharge points, water quality in the river is also influenced by other mine drainage discharges. These discharges overcome the streams residual alkalinity and are primarily responsible for the acid loading of 23.5 tons per day of net acidity discharged at the mouth of the Lackawanna River during a sampling period during the summer months of 1966 and reported in Attachment A to Appendix C, "Prevention of Water Pollution by Drainage from Mines."

The quality of the Susquehanna River in the reach between the Lakawanna River and Nescopeck Creek is impaired by mine drainage contributed by the Lackawanna River and prior to November, 1967, by discharges originating in the Wyoming Valley portion of the northern anthracite field. All of the pumping operations that contributed a significant amount of acid to the Susquehanna River were operated by the Blue Coal Company. The company operated a total of 27 pumps in 17 locations and discharged an average flow of 62 mgd, average acid loading of 180 tons per day of acidity, and iron loading of about an average of 67 tons per day. In November, 1967, the high cost of pumping water and other factors combined to force the Blue Coal Company to discontinue mining operations in the areas that required extensive pumping to keep the mines de-watered. Essentially, all pumping was discontinued. It is estimated that in from two to three years, the mine water pools presently developing will overflow to the surface unless steps are taken to artifically stabilize the levels of pools by pumping. This condition accounts for the potential flooding hazard resulting from the overflow of these mine water pools.

Downstream from Nescopeck Creek, stream quality rapidly improves. Downstream tributaries draining the anthracite area contribute mine drainage but do not significantly effect stream quality.

Abatement and Control Measures. Because of the vast extent of underground workings in the large area disturbed by surface mining in the Lackawanna Basin, it is doubtful that reclamation work alone will effectively abate pollution completely. Reclamation work is needed to reduce the amount of surface water that enters the underground mine workings, but treatment and other abatement methods will also be needed.

The Pennsylvania Sanitary Water Board has sponsored a preliminary study of methods and associated costs of lowering the underground mine water pools below the level of the Duryea and Old Forge discharges and constructing lime neutralization facilities to treat the new combined discharge. The cost of facilities to collect and treat the present average flow was estimated to be $4.3 million. Total annual cost of the facility is estimated to be 760,000 dollars. In the Susquehanna River, the quality of the mine water that will ultimately be discharged from the Wyoming Valley, due to the closing down of the Blue Coal Company mines, is expected to be somewhat poorer than the quality of the discharge prior to November, 1967. Flow regulation or treatment will probably be needed to cope with this problem when the drainage is re-established. It is estimated that collection and treatment facilities to handle the discharge from the Wyoming Valley will cost about $4 million.

Recently the Pennsylvania Department of Mines and Mineral Industries has made arrangements for the construction of a flash distillation plant near Wilke-Barre to treat waters made acid by mine drainage in the Susquehanna River.

An emergency project entitled, "Lackawanna River-Susquehanna River Mine Drainage Abatement, Subsidence Prevention and Flood Protection," the first priority project recommended by the Commonwealth of Pennsylvania

for inclusion in the Appalachian Water Resources Survey, is aimed at correcting the flooding problems, reduction of acid mine discharge, and prevention of subsidence in the Lackawanna and Wyoming Valley. An estimated $68.2 million is required for bore holes, pumps, mine sealing and flushing, mine reclamation, and back filling necessary to curb these conditions. The project was singled out as an emergency by state agencies concerned with water resources because the combination of conditions could severely damage residential and industrial areas. Correction of discharge from the Duryea and Old Forge sites is included in the proposal.

The Schuylkill River which drains a large portion of the southern anthracite field, is rendered acid at its headwaters apparently by runoff from refuse piles and receives additional significant amounts of mine drainage from Middle Creek, West Branch of Schuylkill River, and the Little Schuylkill River. Acid contributed in the headwaters coupled with the acid contributed by the Little Schuylkill River render the stream acid downstream to Reading. An analysis of chemical data obtained by the USGS at Berne, Pennsylvania, (located on the right bank about 6.5 miles downstream from the Little Schuylkill River) shows that total sulfate loadings in the Schuylkill River average 425 tons a day of which about 393 tons a day resulted from mine drainage.

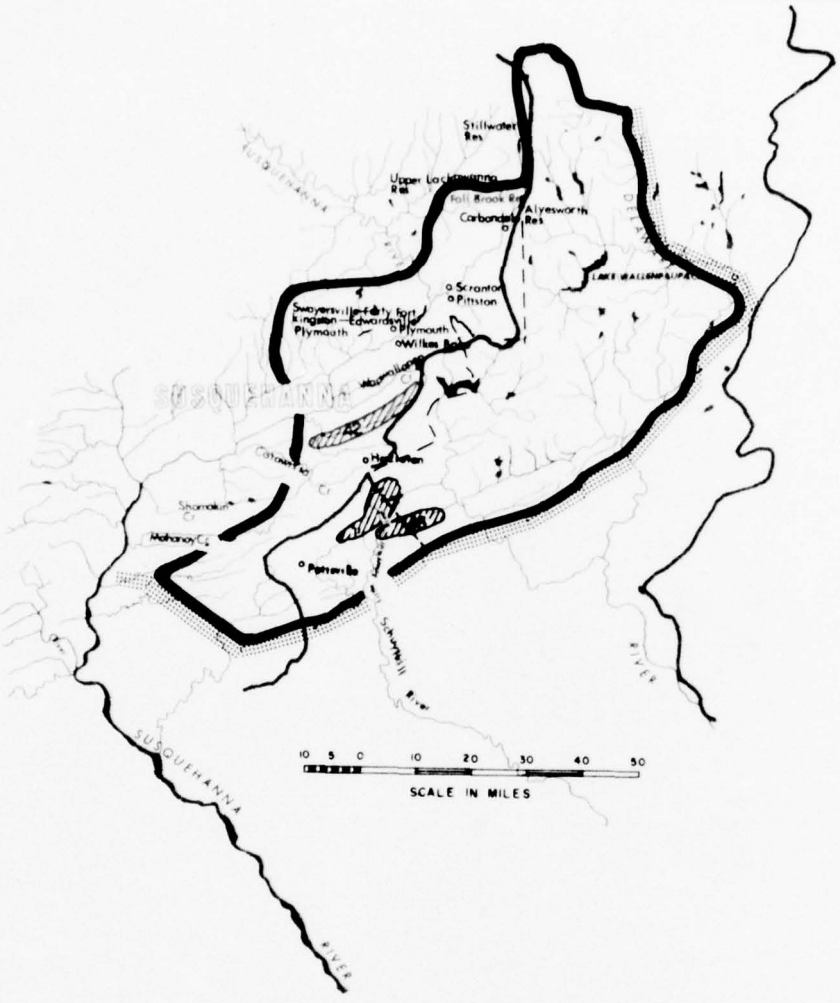
Because of the wide variety of sources and large geographic areas involved, abatement of mine drainage pollution by reclamation alone would probably not be feasible in this basin. Since mine drainage discharges in the basin have relatively low iron concentrations, treatment of major discharges or in-stream treatment might be accomplished at relatively low costs since the need for costly slug handling facilities would be minimal.

As described in Section II of this chapter, the USDA recommendations in Appendix A include reclamation measures on mine disturbed areas. Critical area stabilization practices on 50,100 acres are recommended at total cost of 5,010,000 dollars.

Pocono Counties

The discussion of the Poconos Growth Area in Section II of this chapter implies a low level of water problems for this section of Water Sub-region A (see summary of needs after 1980 in Table 2). Because of the low population concentration and future projections which indicate maintenance of this condition, the internal needs are of low level. However, the location of the Poconos vis-a-vis New York City and Philadelphia and Trenton indicates the pressure for recreational use of this scenic area. Heavy demands for diversion of Delaware River flows to the New York City area is historical. The lower river is subjected to heavy water supply withdrawals for the urban centers located nearby and waste loads discharged to the river are high.

The Delaware River Basin Report and subsequent actions of the Delaware River Basin Commission have outlined a plan of development for the River Basin which accommodates the diverse and open conflicting demands on the river in such a manner as to permit continued economic growth of the areas dependent on the river. A key element of the



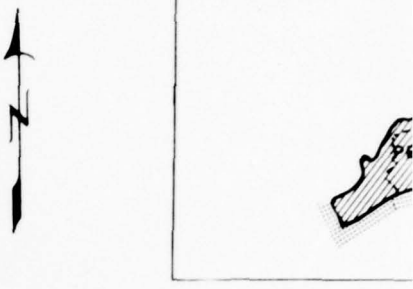
UPSTREAM WATERSHED PROJECT
IDENTIFICATION

EXPECTED TO EXIST BY 1980

11 Little Schulykill River
15 Mauch Chunk Creek

ALTERNATIVE AVAILABLE FOR PLANNING

42 Nescopeck Cr



VICINTY

LEGEND

APPALACHIAN REGION B
WATER SUB-REGION A
STUDY AREA LIMIT
SUSQUEHANNA RIVER B

EXPECTED TO EXIST BY 198

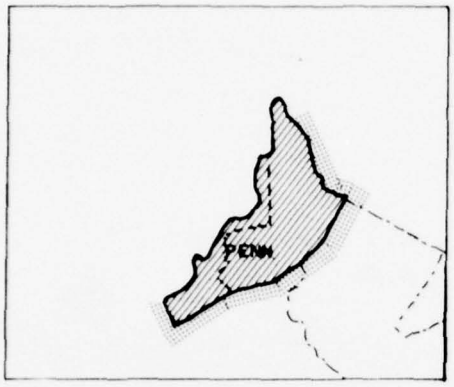
MAJOR RESERVOIR
UPSTREAM WATERSH
LPP PROJECT

PLANNING ALTERNATIVES

UPSTREAM WATERSHED

SUSQUEHANNA RI
PENNSYLVA
WATER SUB-REGI

LOCATION



VICINITY MAP

LEGEND

APPALACHIAN REGION BOUNDARY

WATER SUB-REGION A BOUNDARY

STUDY AREA LIMIT

SUSQUEHANNA RIVER BOUNDARY

EXPECTED TO EXIST BY 1980

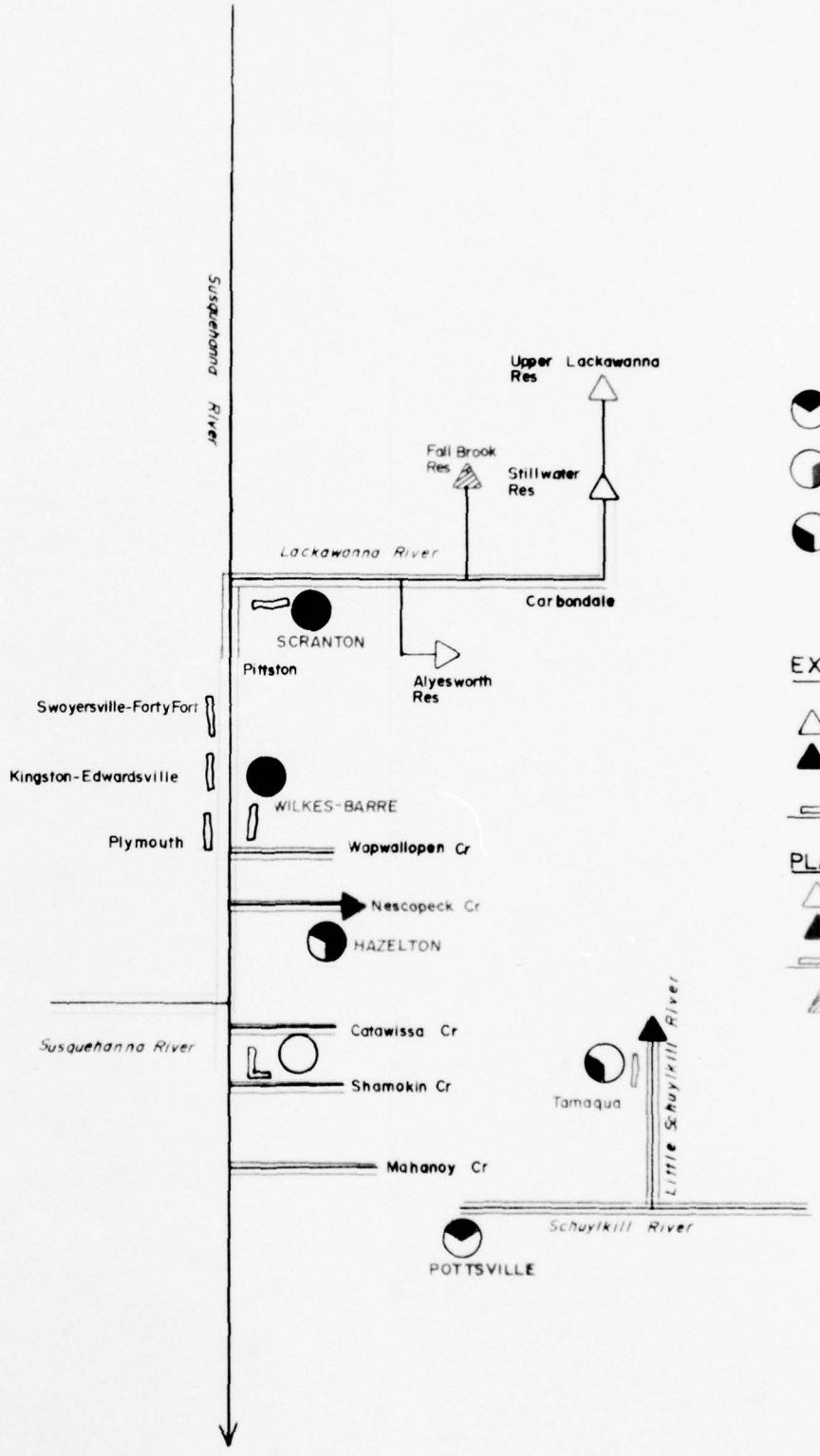
MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

PLANNING ALTERNATIVES

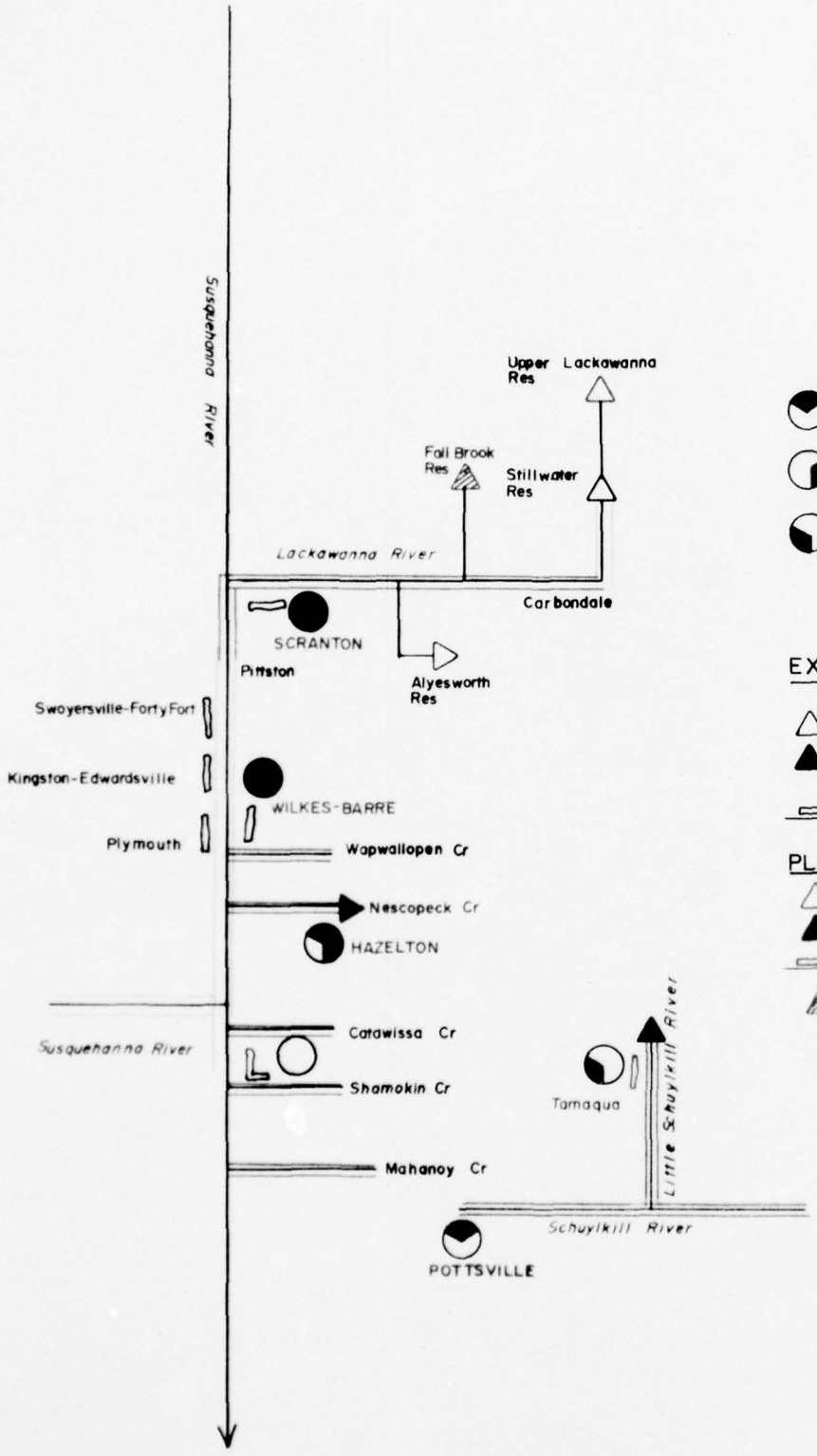
UPSTREAM WATERSHED PROJECT



SUSQUEHANNA RIVER BASIN
PENNSYLVANIA
WATER SUB-REGION A

LOCATION MAP

2



LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- LPP PROJECT

PLANNING ALTERNATIVES:

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- LPP PROJECT
- AUTHORIZED MAJOR RESERVOIR (CE)

OTHER

TOWN NAME PRIMARY GROWTH CENTER
Town Name SECONDARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

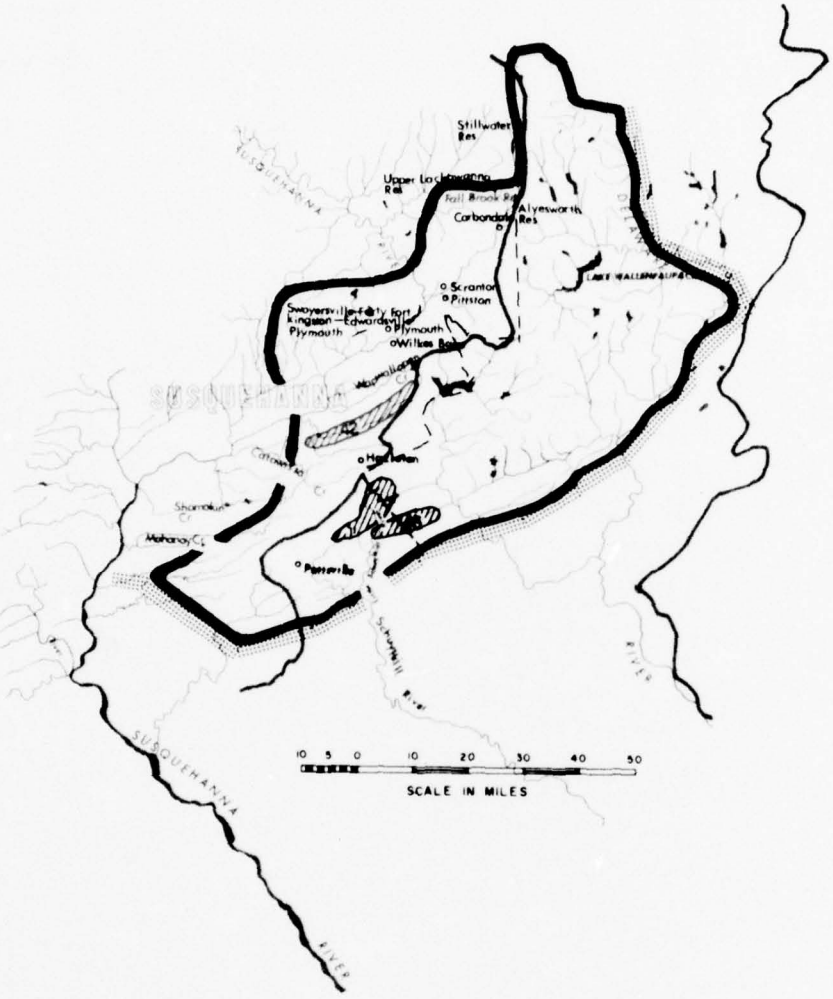
- CONTINUOUSLY
- INTERMITTENTLY

SUSQUEHANNA RIVER BASIN
PENNSYLVANIA
WATER SUB-REGION A

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-2-59

FIGURE 2-18



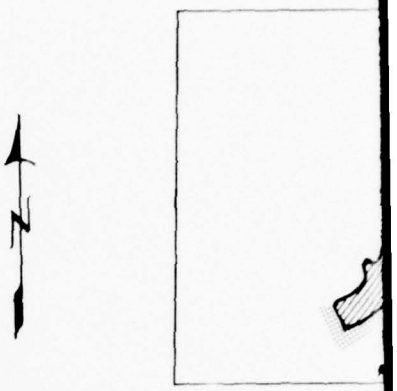
UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

11 Little Schulykill River
15 Mauch Chunk Creek

ALTERNATIVE AVAILABLE FOR PLANNING

42 Nescopeck Cr



VICIN

LEGEND

APPALACHIAN REGION
WATER SUB-REGION
STUDY AREA LIMIT
SUSQUEHANNA RIVER

EXPECTED TO EXIST BY 19

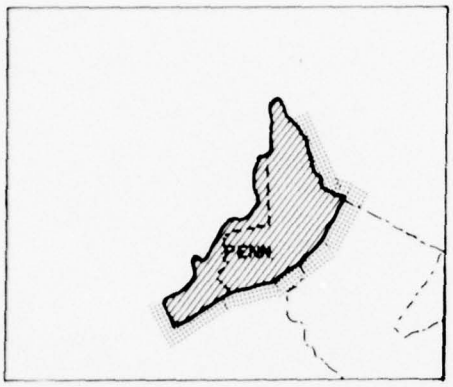
MAJOR RESERVOIR
UPSTREAM WATER
LPP PROJECT

PLANNING ALTERNATIVES

UPSTREAM WATERSH

SUSQUEHANNA R
PENNSYLV
WATER SUB-RE

LOCATIO



VICINTY MAP

LEGEND

APPALACHIAN REGION BOUNDARY

WATER SUB-REGION A BOUNDARY

STUDY AREA LIMIT

SUSQUEHANNA RIVER BOUNDARY

EXPECTED TO EXIST BY 1980

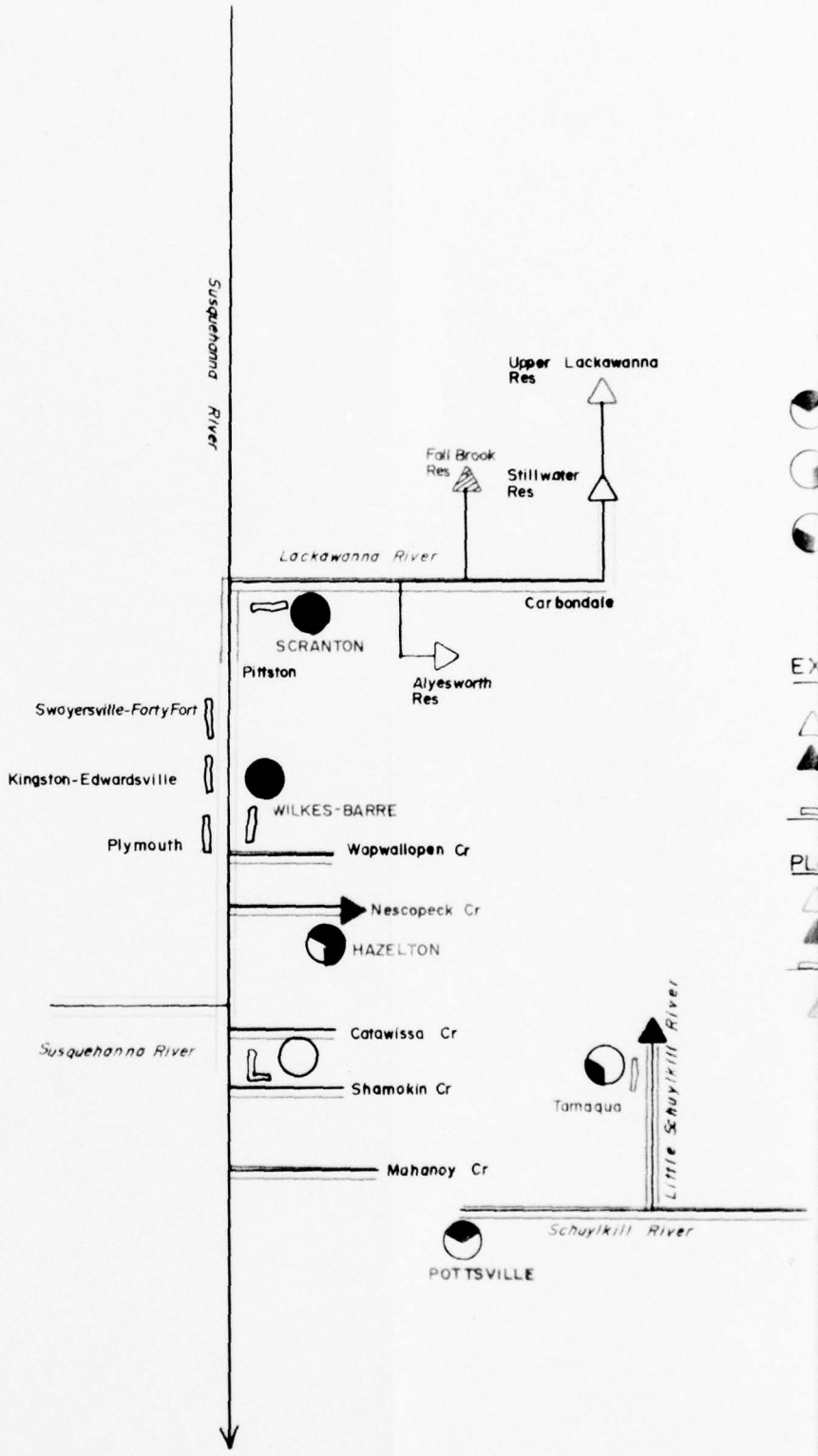
MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

PLANNING ALTERNATIVES

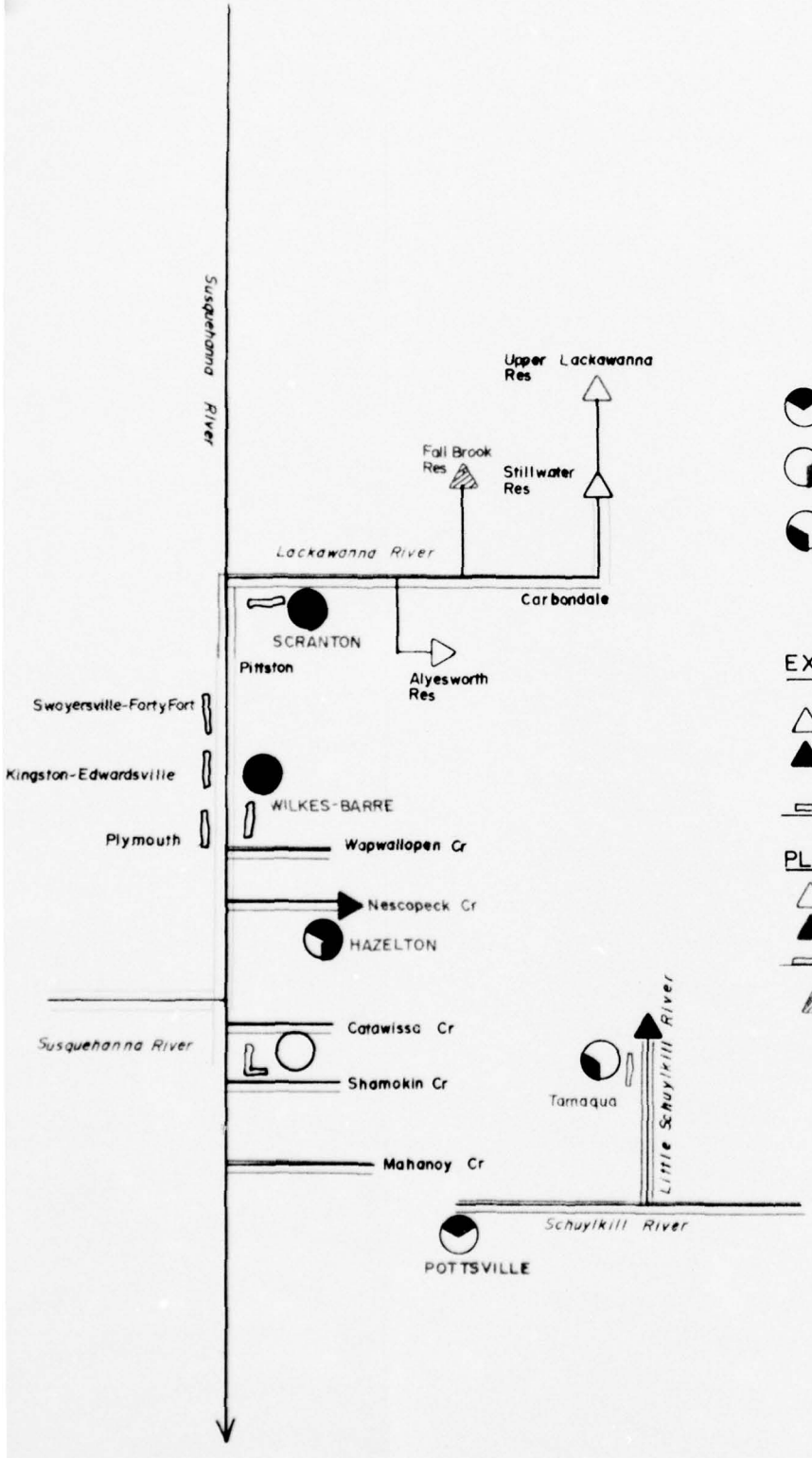
UPSTREAM WATERSHED PROJECT



SUSQUEHANNA RIVER BASIN
PENNSYLVANIA
WATER SUB-REGION A

LOCATION MAP

2



LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- LPP PROJECT

PLANNING ALTERNATIVES:

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- LPP PROJECT
- AUTHORIZED MAJOR RESERVOIR (CE)

OTHER

TOWN NAME PRIMARY GROWTH CENTER
Town Name SECONDARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

- CONTINUOUSLY
- INTERMITTENTLY

SUSQUEHANNA RIVER BASIN
PENNSYLVANIA
WATER SUB-REGION A

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-2-59

FIGURE 2-18

3

developmental plan is the Tocks Island Reservoir and Delaware Water Gap National Recreation Area. Completion of this project will accommodate much of the pressure for additional recreational opportunities on the area and provide an additional economic base for the sizable existing recreation industry. Residual problems for water supply and quality are minimal within the Poconos Growth Area; however, the combination of terrain and developmental patterns will leave a sizable flood control problem.

Figure 2-19 indicates the location and arrangement of the water resource development anticipated to be in place by 1980. Low flows on the Delaware River on entry to Sub-region A have been diminished by the operations of Cannonsville and Pepacton Reservoirs for water supply purposes for New York City. Low flow diminution does not adversely affect downstream riparian users in Sub-region A. Modification of the Prompton Reservoir to increase water supply was authorized in the Delaware River Comprehensive Report and scheduled for 1974. Modification of the Francis E. Walter Reservoir for increased water supply is scheduled for 1989. Completion of Beltzville Dam is scheduled for 1970, and completion of Aquashicola is scheduled for 1980. Thus, implementation of the Delaware River Basin Plan will both meet most water control needs and increase supply of slack water for recreation in the Pocono Growth Area.

Additional needs for water supply, quality control, conservation and land development on a localized basis have been asserted by local interests and described in the Pennsylvania Water Supplement (Chapter 9, Part V, of this report) and in the USDA Appendix A, Agriculture, Forestry, and Conservation. Implementation of the small flood control reservoir program proposed in the Delaware River Report would reduce flooding damages from $1,040,000 to $576,000 annually (1968 level of development).

Carbon County - (Jim Thorpe-Lehighton)

The estimated water needs of the growth center are as follows:

Flooding Damages (1980)	$9,000
Water Supply (2020)	31 mgd
Water Quality (2020)	36 cfs
Land Development (2020)	170 acres

Alternative means for meeting these needs include:

1. Flood Control	Damage Reduction	Est. Annual Costs
Flood Plain Management	NA	NA

2. Water Supply (31 mgd)	Yield	Est. Annual Costs
Beltzville Reservoir	31 mgd	$250,000 - $500,000*/
Mauch Chunk Upstream Watershed Project (USDA)	4 - 5 mgd	$ 15,000 - $ 30,000*/
Ground Water	31 mgd	$500,000 - $1,000,000*/
Pump from Lehigh River	31 mgd	NA
3. Water Quality (36 cfs)		
From Impoundments	36 cfs	$150,000 - $300,000
Advanced Waste Treatment	(36 cfs)	$ 20,000 - $ 30,000

Additional reduction of flooding damages by structural measures appears limited, although flood plain management practices could be adopted to minimize future damages. Additional water supply may be developed in upstream structures, from ground water sources or the Lehigh River (if water quality standards are implemented). Although a precise estimate of pumping costs from the Lehigh River is not currently available, this source would probably be more economical than the other indicated alternatives. Some form of advanced waste treatment appears to be the most practical method for maintaining the required levels of dissolved oxygen in the stream receiving municipal and industrial wastes.

Monroe County - (Stroudsburg-E. Stroudsburg)

This growth center will be measurably influenced by the construction of the Tocks Island Reservoir and the Delaware Gap Natural Recreation Area.

Additional water needs are as follows:

Flooding Damages (1980)	$78,000
Water Supply (2020)	25 mgd
Water Quality (2020)	161 cfs
Land Development (2020)	170 acres

*/ Does not include transmission costs from reservoir or wellhead to distribution system.

Alternatives for meeting these needs include:

	Damage Reduction	Est. Annual Costs
1. Flood Control ($78,000)		
Small Flood Control Projects (CE)	$35,000	$ 26,000
Flood Plain Management	NA	NA
2. Water Supply (58 mgd)	Yield	
Tocks Island Reservoir	25 mgd	$ 70,000 - $200,000*/
Upstream Impoundments	25 mgd	$ 90,000 - $200,000*/
Ground Water Sources	25 mgd	$400,000 - $1,300,000*/
3. Water Quality (161 cfs)		
Upstream Impoundments	161 cfs	$500,000 - $1,000,000
Advanced Waste Treatment	(161 cfs)	Less than $100,000

Additional flood protection from the small flood control structures authorized for the Delaware River Basin Comprehensive Report would reduce damages to about $43,500 annually. Flood plain management practices should be adopted to control future development in the flood plain. Provision of adequate water supply appears to be practical from a number of sources. Water Quality Management will become more important to the area with the construction of the Tocks Island Reservoir as a means of maintaining the quality environment necessary to allow exploitation of the recreation industry.

Wayne County - (Honesdale)

Water needs of the Honesdale Growth Center include the following:

Flooding Damages (1980)	$17,000
Water Supply (2020)	4 mgd
Water Quality (2020)	34 mgd
Land Development (2020)	90 acres

---

*/ Plus transmission costs.

Alternatives for meeting the needs at Honesdale include:

1. Flood Control ($100,000)	Damage Reduction	Est. Annual Costs
Upstream Reservoirs	NA	NA
Local Protection	NA	NA
Flood Plain Management	NA	NA
2. Water Supply (4 mgd)	Yield	
Prompton Reservoir	4 mgd	$ 30,000 - $ 60,000*/
Ground Water Sources	4 mgd	$ 75,000 - $150,000*/
Pump from Lackawaxen River	4 mgd	Less than $30,000
3. Water Quality (34 cfs)		
Augmentation from Prompton	34 cfs	$150,000 - $300,000**/
Advanced Waste Treatment	(34 cfs)	$ 25,000 - $ 50,000

Honesdale is well protected from flooding damages along Lackawaxen River by two reservoirs and an extensive channel rectification project. Further studies will be required to develop a solution for the residual problem (mainly associated with flooding of Dyberry Creek), but it seems probable that flood plain management will prove to be the most feasible means of further reduction. Additional water supply should be available from ground water sources. Low flow augmentation from normal minimum releases from Prompton Reservoir should provide adequate augmentation for all except drought years, but in view of preserving the quality of the water for downstream users, advanced waste treatment should be encouraged.

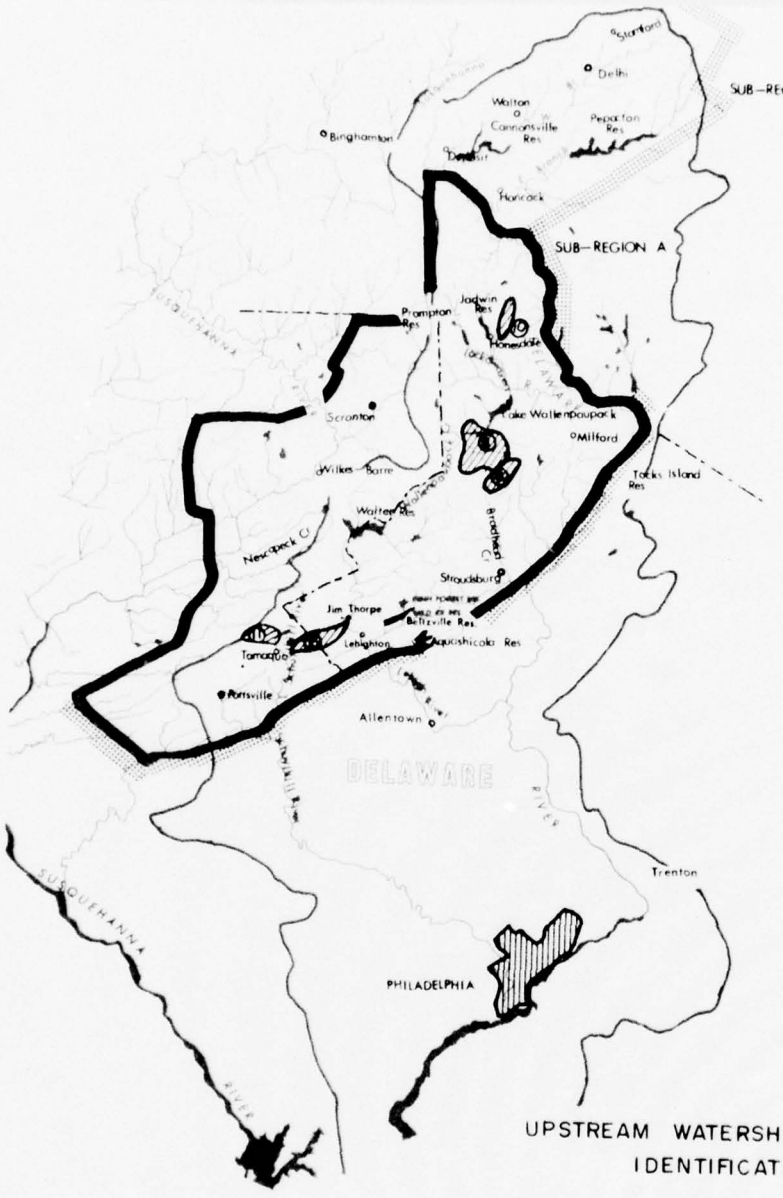
Mine Drainage and Pollution

The only stream seriously affected by acid mine drainage in the Pocono Counties is the Lehigh River. Essentially all of the mine drainage in the basin originates in abandoned mines. Municipal and industrial effluent from Hazelton is discharged into Black Creek, a

---

*/ Plus transmission costs.

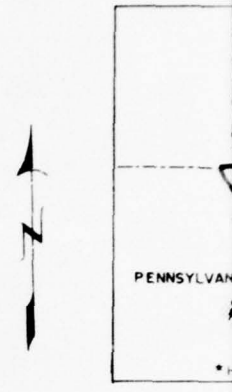
**/ Probably chargeable to downstream users.



UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

6 Brodhead Creek
8 Green Dreher
10 Lackawaxen Tributaries
11 Little Schuylkill River
15 Mauch Chunk Creek



LEGEND

APPALACHIAN
WATER SUB-RE
STUDY AREA
DELAWARE RIV

EXPECTED TO EXIST

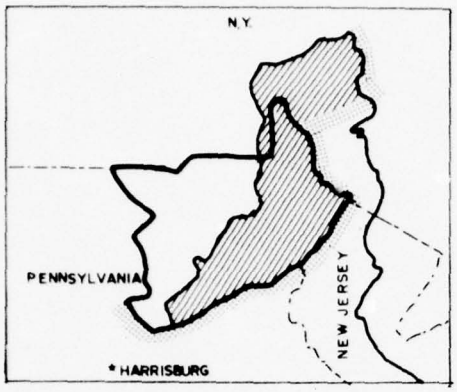
MAJOR RES
UPSTREAM
LPP PROJEC

PLANNING ALTERNA

LPP PROJEC

DELAWA
PENNSYL
WATER S

LOCA



VICINITY MAP

LEGEND

APPALACHIAN REGION BOUNDARY

WATER SUB-REGION A BOUNDARY

STUDY AREA LIMIT

DELAWARE RIVER BASIN BOUNDARY

EXPECTED TO EXIST BY 1980

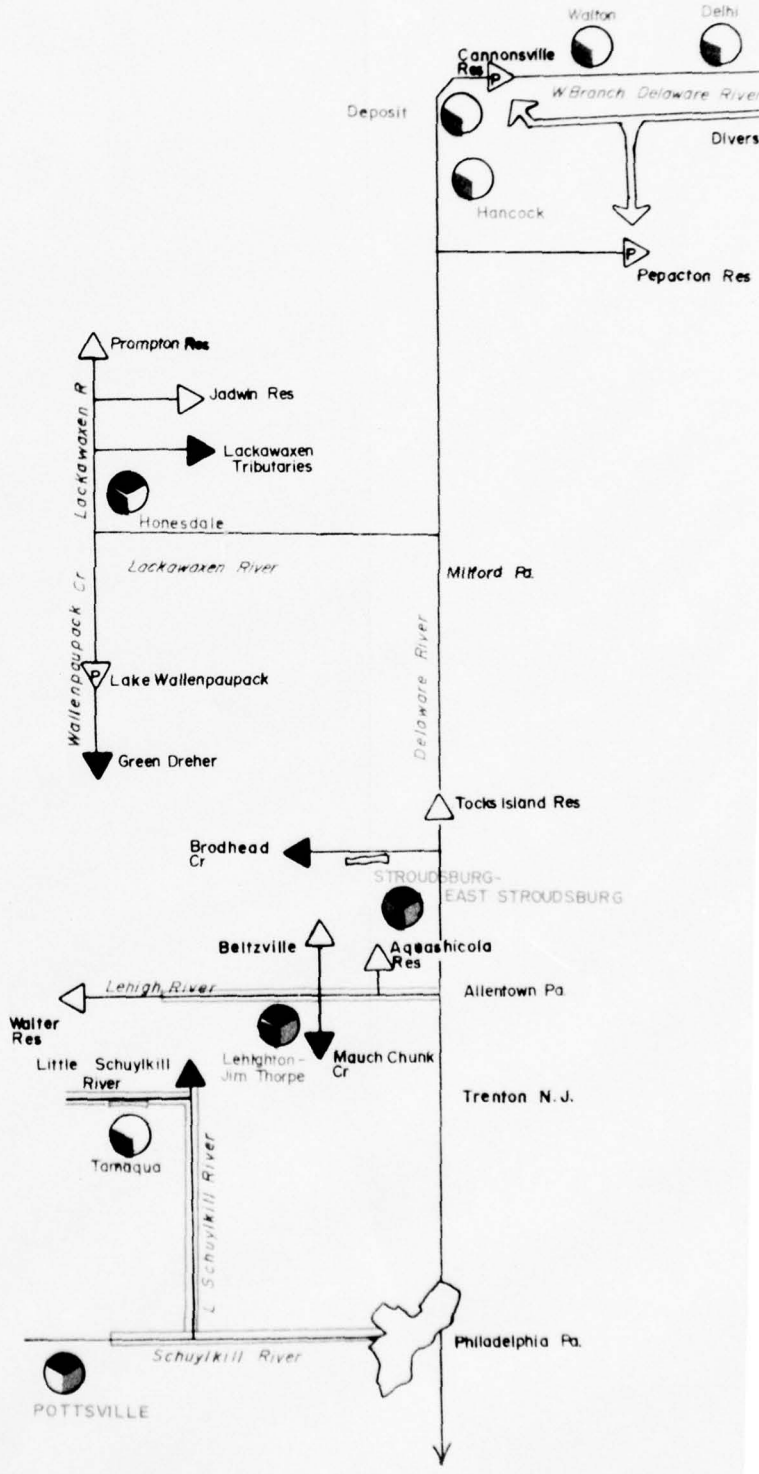
MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

PLANNING ALTERNATIVES

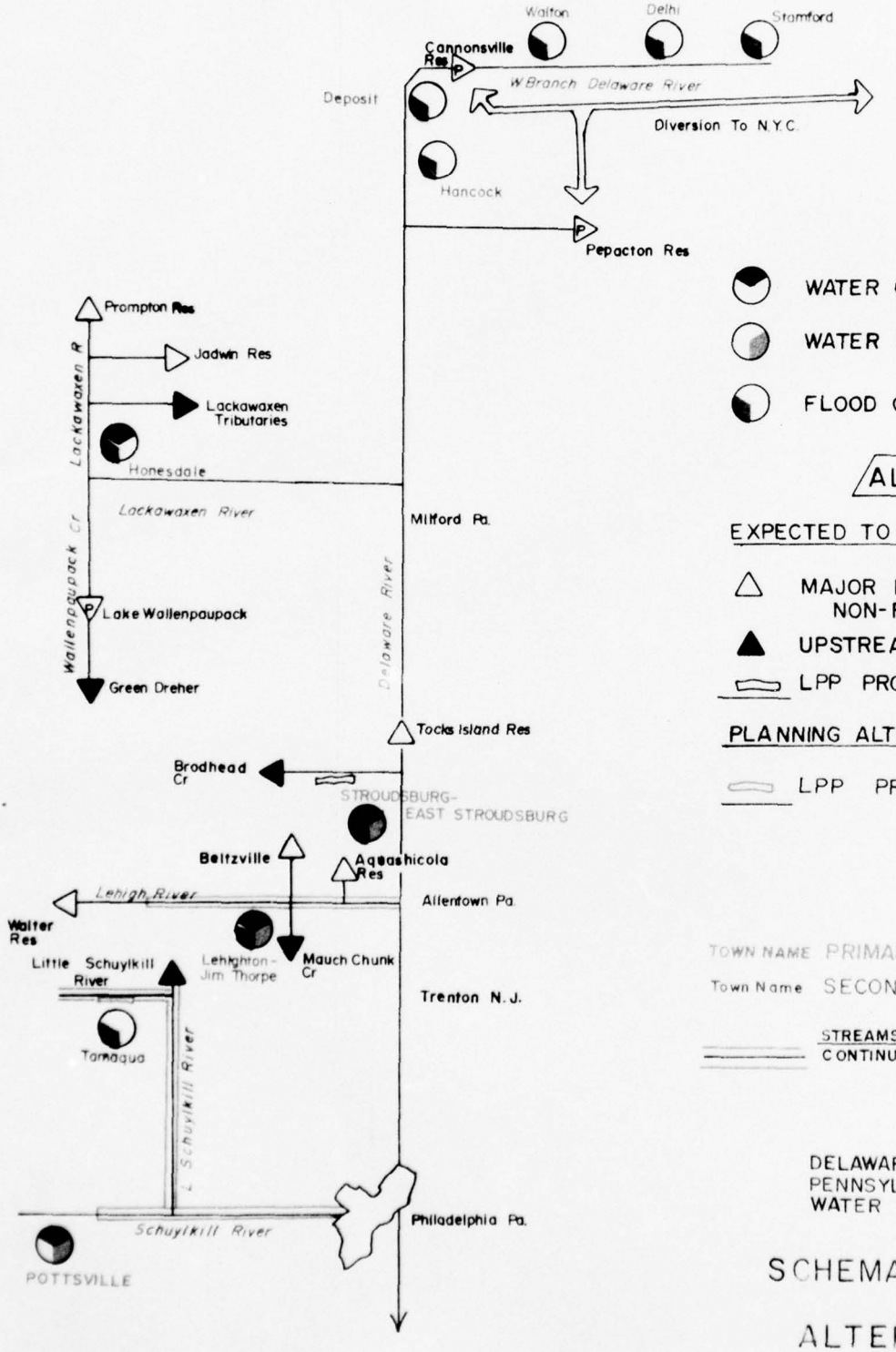
LPP PROJECT



DELAWARE RIVER BASIN
PENNSYLVANIA AND NEW YORK
WATER SUB-REGION A

LOCATION MAP

2



LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- LPP PROJECT

PLANNING ALTERNATIVES:

- LPP PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER

Town Name SECONDARY GROWTH CENTER

STREAMS AFFECTED BY MINE DRAINAGE CONTINUOUSLY OR SIGNIFICANTLY AFFECTED

DELAWARE RIVER BASIN
PENNSYLVANIA AND NEW YORK
WATER SUB-REGION A

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

FIGURE 2-19

tributary of the Lehigh River. As previously discussed, advanced waste treatment measures are recommended to control this source of pollution.

Attachment A of Appendix C "Prevention of Water Pollution by Drainage from Mines" indicates that it is doubtful that reclamation measures alone would be adequate to restore the level of water quality to an acceptable level. Treatment with lime - neutralization process appears to be possible at moderate costs.

10. THE SYSTEM - SUB-REGIONAL

General

The preceding paragraphs have discussed the problems relating to flooding, water supply, water quality control and land development for the growth centers in Water Sub-region A. However, the needs identified for other areas must be considered to develop a balanced water plan. These are discussed in subsequent paragraphs along with the needs for recreation and conservation which are best discussed in the context of the whole sub-region.

Flood Control

From the sub-regional standpoint, the growth centers account for about $1,107,000 of annual flood damages compared to total flooding damage estimate of $2,452,000 (remaining in 1980; based on 1968 level of development). Upstream watershed projects of the USDA will provide benefits in many of these areas.

A number of potential projects have been identified through the studies undertaken in the AWRS by cooperating Federal and non-Federal agencies. Some of the most promising potential projects are listed below.

Wyoming and West Wyoming (Luzerne County) Flood Protection Project

Abrahams Creek, which flows through the Boroughs of Wyoming and West Wyoming, has on numerous occasions flooded over its banks, and damaged residential areas. The largest flood on record occurred from a local storm in July 1946. This flood resulted in $416,000 damages. Two hurricane floods in 1955 caused $285,000 damages to the two Boroughs. The January 1959 flood caused $135,000 damages.

The project necessary to alleviate flooding problems consists of 5,000 feet of improved channel, with a capacity of 2,200 cfs. The cross section of the upstream 3,700 feet, which is concrete-lined, varies between a 15-foot bottom width, rectangular, to 12-foot bottom width, trapezoidal. The remaining length is earth channel, with a 30-foot bottom width, trapezoidal in section. An 800-foot length of levee,

with a maximum height of four feet, is required on the right bank upstream from the concrete channel to ensure that the entire design flow enters the channel.

Construction costs for this project are estimated at 500,000 dollars. The benefit-cost ratio for flood control in the Boroughs of Wyoming and West Wyoming is 2.12. Preliminary designs have been completed for this project. It is listed for priority consideration in the Pennsylvania State Supplement to the Appalachian Water Resources Plan.

Local Flood Protection at Wabash Creek, Tamaqua, Pennsylvania

The Borough of Tamaqua, Schuylkill County, Pennsylvania, was heavily damaged by concurrent flooding of the Little Schuylkill River and Wabash Creek following Hurricane Dianne in August 1955. Total damages in excess of $1.3 million were sustained, of which $526,000 was attributed to Wabash Creek alone.

Four small control structures, subsequently constructed by the U.S. Soil Conservation Service on the Little Schuylkill River and tributaries upstream from Tamaqua, are expected to result in reduced damages resulting from flooding of the Little Schuylkill River. There is, however, a significant residual damage potential from Wabash Creek.

One of the functions of the proposed project is to support rehabilitation and renewal of approximately six acres of the Tamaqua business district. This renewal will result in land enhancement and increased incentive for expansion of commercial and light industrial activity in the community.

The major feature of the project involves relocation of the channel of Wabash Creek into a by-pass tunnel under Sharp Mountain on the south side of the Borough. The tunnel is designed to by-pass the runoff (from the 100-year flood) around the town. The tunnel would obviate the need for carrying storm runoff from three quarters of the drainage basin through the present antiquated and undersized stone-arch culvert which carries Wabash Creek through a tortuous course under the Tamaqua business district.

Total costs and benefits stemming from the project are as as shown:

Total Cost	Average Annual Cost	Total Average Annual Benefits	
$2,355,000	$ 82,000	$127,000	(User)
		298,000	(National Expansion)
	369,000	747,000	(Regional Expansion)

Plymouth, Luzerne County, Local Flood Protection from Wadham Creek

Wadham Creek drains approximately one square mile of relatively steep land, much of which is mined acreage, above Plymouth, Luzerne County. Resultant excessive runoff from heavy rainfall, combined with sediment deposits from the culm banks and the inadequacy of existing culverts, contributes to frequent flooding of an area equivalent to five city blocks in the Borough of Plymouth.

Serious flooding occurred in the area between Turner Street and Main Street and along Main Street in 1942, 1946, 1947, 1952, 1955 and 1966. Greatest damages to date were experienced in August of 1955. Some of the damage can be attributed to deposition of bedload that, since 1959, has been reduced by the construction of a debris basin on Wedham Creek, above Plymouth.

An engineering planning study has recommended the construction of 2,200 feet of rectangular concrete channel from the debris dam downstream to a point 300 feet above the pumping station on the Susquehanna River levee. Three hundred feet of the channel would be closed culvert under three streets. Some realignment is necessary. A stilling basin should also be provided at the end of the channel. Estimated costs are $400,000.

Swoyersville and Forty-Fort (Luzerne County) Local Protection Project

The Boroughs of Swoyersville and Forty-Fort, Luzerne County, have experienced flooding along the South Branch of Abrahams Creek as a result of mine subsidence since 1940.

The residential area of Swoyersville has received most of the flood damages. Some flooding has affected a residential section in Forty-Fort called Englewood Terrace. Certain areas in the Borough of Swoyersville have been made uninhabitable. Adjoining areas are subjected to frequent flooding and to objectionable and unsanitary conditions created by stagnant water.

During the period, 1953 to 1958, the Borough of Swoyersville had $115,000 of direct flood damages. This did not include loss of wages, depreciation of affected property values, indirect damages, inconveniences and disruption of activities caused by floods, or the effect of ponded stagnant water on the health of the community. Average annual damages for the two boroughs combined is estimated at 69,300 dollars.

The proposed project involves 14,250 feet of channel improvement and 1,600 feet of 7-foot diameter pressure conduit. Most of the channel work involves deepening of the existing channel. Control structures

are planned to divert flood peaks into three ponding areas to be stored until after the flood is passed, and then to slowly be released. The estimated construction cost of this project is 650,000 dollars. Its benefit-cost ratio is 1.95.

Blakely (Lackawanna County) Local Protection Project

Hull Creek drains 3.2 miles of pasture and forest land on a high, rolling plateau above the community of Blakely, Lackawanna County. Debris from culm piles, and eroded material from the stream banks of glacial drift, are picked up by heavy runoff in quantities too great to be transported any distance by the stream. Consequent deposition of this bedload downstream decreases the capacity of the channel.

Severe flooding along much of Hull Creek through Blakely occurred in July 1920 and May 1942. The most devastating flood was that of 21 May 1947. This flood caused damages estimated at $200,000 by the Borough of Blakely. Nuisance flooding has occurred periodically since, undermining channel walls and the foundations of homes.

A project plan has been developed to alleviate this problem that would:

(1) Pass discharges exceeding the flood of record;

(2) Eliminate bedload deposits by reducing sediment to the point at which increased channel velocities would prevent settlement of the remaining suspended material; and

(3) Replace numerous deteriorated walls and structures, removing a serious threat to life and property during periods of high water.

The project would extend along 2,500 feet of Hull Creek upstream from the creek's outlet into the Lackawanna River. An open concrete 10' x 10' channel has been designed to carry 1,700 cfs on a 3 to 3.5 percent grade at velocities of 30 to 40 feet per second. Upstream from the channel, the existing debris basin will be rebuilt, and trash racks installed. A derrick stone outlet is contemplated below the channel. Preliminary design has been completed. Construction cost for the work is estimated at 600,000 dollars.

The Pennsylvania Department of Mines and Mineral Industries has been requested to participate in the removal of the culm piles upstream of the channel. This phase of the project is most essential for its success.

Restoration of Deer Lake Reservoir, Deer Lake, Schuylkill County, Pennsylvania

Deer Lake is an existing 22-acre reservoir on Pine Creek located in Deer Lake Borough, Schuylkill County, Pennsylvania. The reservoir, originally constructed in 1928 for the purpose of providing outdoor recreation for the residents of the surrounding area, has become choked with sediment the dam has partially deteriorated.

It is proposed to restore and improve this reservoir, and provide facilities for outdoor recreation on the public lands surrounding it. The project has strong local support on the grounds that restoration of of the lake would provide a much-needed recreation facility. It would also remove a health hazard and an eyesore, and stimulate economic growth in the area.

Due, in part, to the advanced degree of planning by local groups for this project, and also to the evident need for local outdoor recreation facilities in the area, a detailed study of the project was completed by the Corps of Engineers in October 1967.

The proposed plan of improvement involves:

(1) Dredging the lake to planned design depth;

(2) Repairing the existing dam, including sluice gates and wing walls; and

(3) Constructing recreation facilities on public lands surrounding the lake, designs for which provide for a total of 33,000 visitor-days annually for local users.

Total costs of construction are estimated to be 677,000 dollars. Annual costs, computed on the basis of a 50-year life, are 46,000 dollars. Average annual benefits from recreation and area development purposes are expected to exceed 63,800 dollars.

Restoration of Lake No. 1 at Tobyhanna, Pennsylvania

The Village of Tobyhanna is part of Coolbaugh Township, in Monroe County. Tobyhanna Lake No. 1 was originally formed by a low dam across Tobyhanna Creek, at the northern edge of the Village of Tobyhanna. This dam was built about 1875. The lake was known as Mill Pond No. 1. It was used as a pond for harvesting ice.

Later, a second and higher dam was constructed about 100 yards downstream. It was formed of concrete, dumped rock and logs. This dam raised the water to about 8.5 feet above its present level. The

dam was allowed to deteriorate to a point where a desirable water level in the lake could not be maintained. In 1952, it was replaced by a concrete dam.*/ This dam was destroyed in August 1955, by floods that resulted from Hurricanes "Connie" and "Diane."

Since the dam failure of August 1955, Tobyhanna Lake No. 1 has been an unsightly and unhealthy blight to the surrounding area. No efforts have been made since 1955 to remedy this situation, even though the Village of Tobyhanna is in need of a water supply for fire protection.**/ The problem is:

(1) To change the lake from a privately owned swamp that is of no benefit to the Village of Tobyhanna to a beautiful lake, with large public areas that have all the facilities for recreation and resort development needed to improve the social and economic levels of the Village of Tobyhanna and the surrounding region; and

(2) To provide a dependable source of water supply for fire protection.

A reconnaissance investigation of the area was made by the Corps of Engineers in 1966. A plan for restoration of the lake has been formulated that involves:

(1) Drainage and removal of stumps and debris from the reservoir area;

(2) Construction of a new concrete overflow dam;

(3) Construction of picnic areas, a boat launching site, a swimming beach, parking areas and cycling paths on lands around the lake that were to be acquired for public use.

This improvement is designed to provide: (a) a total of 64,200 outdoor recreation days for local users; (b) a dependable source of water supply; (c) removal of an existing health hazard; (d) additions to the natural beauty of the area; (e) an increase in the economic level of the area in general.

---

*/ The replacement dam was built largely through the efforts of the Roman Catholic Diocese of Scranton, which operates a large non-profit girls' camp on the east shore of the lake.

**/ In 1964, the Methodist Church of Tobyhanna was razed due to lack of water in the lake for use by fire-fighting equipment.

Total estimated costs of the project are 827,000 dollars. Total annual charges are estimated at 43,000 dollars. These charges are compared with average annual benefits of $212,000, based on user benefits alone. The plan has a benefit-to-cost ratio of 5 to 1.

Water Supply and Water Quality

The needs for additional water supply by 2020 in the growth centers of Water Sub-region A are estimated to be 561 mgd of 713 mgd total needs. USDA upstream watershed projects and ground water sources can probably be developed to meet these needs. There are no identified needs for water quality control measures not associated with the growth centers.

Recreation

The massive increase in the needs for additional opportunities for outdoor recreation have been discussed previously. Water plays an important part in enhancing the scenic endowment of an area and in providing opportunities for water related outdoor recreation.

As previously discussed, construction of the Tocks Island Reservoir and the Delaware Gap National Recreation Area will add a substantial capability to the region's recreational industry. Modification of the Prompton and Jadwin Reservoirs will enhance their value for water related recreation. Upstream watershed projects can contribute to the satisfaction of recreational needs.

The AWRS has evaluated additional measures which are oriented to renovation of existing resources serving local communities as follows:

Conservation

Upstream watershed developments have been mentioned in preceding paragraphs when discussing the problems of the various growth centers. However, there are many problems over the sub-region that revolve around floodwater damage, erosion and sediment damage, agricultural water management, and the management of cropland, grazing land, and the forested areas. These are all problems that fall under the purview of the Department of Agriculture and particularly to the Soil Conservation Service and the Forest Service. Discussion of these problems is in Appendix A of this report.

Preservation of Surface and Ground Water Quality

Lackawanna and Luzerne Counties. The present organic pollution problem is approaching solution in these two counties in the Susquehanna Basin. In Lackawanna County, the Lackawanna River Basin Authority, the Greater Scranton Sewer Authority, and the Lower Lackawanna Sewer Authority have collection and complete treatment systems under design contract or construction. These are scheduled to be in operation by 1971.

In Luzerne County, the Greater Hazelton Area Joint Sewage Authority now has primary-secondary sewage treatment in operation. Fourteen communities, including Wilkes-Barre, constitute the Wyoming Valley Sewer Authority. These communities, in addition to six additional communities, will be served before 1970 by a single collection and treatment system now under construction. This system has design capacity for accommodating at least six additional communities that would logically connect with it. The Black Mountain Sewer Authority has been formed for design and construction of a primary-secondary plant serving the Dallas area.

Six sewage authorities are in the process of being formed to meet the needs of approximately 15 communities not served by existing or planned systems. It is estimated that by 1971, approximately 95 percent of the population in this two-county area will be connected to systems, the discharge from which will receive at least primary treatment. About 40 percent of the population, primarily in Lackawanna County, where the need is greatest, will receive both primary and secondary treatment.

Schuylkill County. Control of surface and ground water pollution is regarded as a high priority need by the Schuylkill County Planning Authority. At present, sanitary sewage collection systems are limited to the City of Pottsville and the various Boroughs of Schuylkill Haven, Orwigsburg, Cressona, St. Clair and Tamaqua. Efforts are being made to establish treatment facilities for the City of Pottsville. Substantial improvement in pollution control is expected in the future as a result of recently enacted state and federal clean streams legislation.

Carbon County. The Carbon County Planning Commission recognizes the importance of mine and sewage pollution control in preserving and enhancing the county's natural outdoor recreation resources. A water and sewage master plan is being prepared. The Commission is also studying various means for obtaining Federal and state assistance for implementation of the plan.

Monroe, Pike and Wayne Counties. The problem of pollution of ground water, streams and lakes caused by inadequate and poorly planned sewage disposal systems by development contractors is already manifest in these rapidly developing residential counties. Measures must be taken to reverse the trend toward pollution.

Monroe County plans to inaugurate an extensive county-wide Comprehensive Water and Sewage Study to prepare an overall water and sewage plan that will: (a) meet the objectives of the recently enacted Pennsylvania Sewage Facilities Act; and (b) be compatible with the program currently being developed by the Delaware River Basin Commission and Tocks Island Regional Advisory Council. In addition, the Monroe County Planning and Zoning Commission has developed sub-division

regulations and model zoning ordinances designed to preserve ground and surface water resources from anticipated pollution. Such pollution is anticipated from the acceleration of residential and commercial building activities expected to accompany the development of the Tocks Island project.

Wayne County has only recently established a planning commission. Realizing that the county shares the same pollution problems existing in Monroe County, the Commission is actively studying means for implementing zoning ordinances and building codes necessary for more effective future pollution control.

Pike County has no county planning commission. Planning functions heretofore have been relegated to individual township planning boards. Pike County, however, is directly involved in the water supply and sewage disposal program being developed by the Delaware River Basin Commission and the Tocks Island Regional Advisory Council. The County's effort toward ground and surface water pollution abatement will benefit from the expertise supplied by these agencies.

11. SELECTED PLAN

Figure 2-20 portrays the recommended plan of development for water resources in Water Sub-region A. There are two categories of project portrayed on this plate. The current program of water development which can be assumed to be in place in 1980 is shown as "existing," while new proposals are in the "selected" category. Recommendations for further studies are outlined by area involved or by specific location if the area is quite limited.

A ranking of proposals by urgency of implementation is indicated below, to indicate the priorities for programming studies and construction. The priorities implied may be modified, when capabilities are considered and the effects of continuing investigations are added. Thus, priorities indicate the current status of information and omit consideration of capabilities to implement studies or projects. The most urgent classification (I) should be given immediate priority and implementation. The second order of urgency (II) implies implementation within about five years, while the third order (III) would be deferred for more than five years.

I - Immediate Implementation

Element A. Accelerate the going program for mine drainage pollution abatement for abandoned mines, and initiate a parallel program of land treatment and watershed protection projects in areas that have been adversely affected by past anthracite mining operations.

The Lackawanna-Wyoming Valley Environmental Study. Lackawanna and Luzerne Counties, in the Susquehanna Drainage Basin (Anthracite Counties) contain most of the major population and trade centers of Water Sub-region A. These counties also account for a major portion of the unsolved water and related land resource developmental problems in the Water Sub-region.

The economy of this two-county complex, containing the Standard Metropolitan Statistical Areas (SMSA's) of Scranton and Wilkes-Barre-Hazelton, has been strongly influenced by fluctuations in anthracite mining activity. Mining's residual problems have involved water pollution, urban and rural blight, out-migration of the labor force, and general deterioration of the economic base in the Water Sub-region.

In prelude to formulation of specific plans and programs to eliminate known deterrents to economic growth in the Anthracite Counties of Water Sub-region A, a comprehensive study of specific problems involved in the Wyoming and Lackawanna Valleys, was undertaken. These Valleys are typical of those in all Anthracite Counties in the Water Sub-region.

The objectives of the study were to:

(1) Relate economic conditions in the study area to natural and human resource problems and deficiencies;

(2) Present a range of realistic solutions that could solve or mitigate economic problems;

(3) Assign priorities to proposed solutions according to their beneficial effect on the economy of the study area, based on cost and effect studies, considering both tangible and intangible benefits; and

(4) Specify costs of priority natural resource development solutions, and effects of the entire economic development program, as to private and social costs and benefits.

In fulfilling these objectives, attention was directed toward problems induced by water and related land resources that have been affected by anthracite mining activities. Problems involving needs for municipal and industrial water supply, flood control, water quality control, and outdoor recreation were analyzed in significant detail.

Conclusions reached as a result of this study were that the two most serious obstacles to sustained economic growth in the study area are:

(1) Physical scars to the land, and stream pollution; both resulting from strip and deep mining operations in the past; and

(2) Lack of specific skills in the labor force.

Primary recommendations for water and related land resources development necessary to support sustained economic growth advocated implementation of a comprehensive land reclamation program. This program should be designed to:

(1) Make existing wastelands available for better economic use; and

(2) Prevent acid mine drainage pollution of streams.

It was further recommended that greater emphasis be placed on strip land reclamation programs, as well as current programs for extinguishing mine and bank fires, controlling subsidence and treating of mine drainage.

Comparison of data compiled by the U.S. Bureau of Mines and the Federal Water Pollution Control Administration (FWPCA) for various methods of land treatment and construction has indicated that further detailed study may prove such projects to be economically feasible; in some cases, on the basis of user benefits alone.

Pennsylvania's Ten-Year Mine Drainage Pollution Abatement Program for Abandoned Mines. The objectives of this current program are in accord with those of Element A of the plan for full water resources development in Water Sub-region A. The program is divided into four phases as follows:

Phase 1 - Location of Water Pollution Sources
Phase 2 - Engineering Studies and Plans
Phase 3 - Construction
Phase 4 - Operation and Maintenance

The objective of this program is to abate mine pollution from abandoned mines through the least expensive combination of the following construction practices:

(1) Sealing of deep mines;

(2) Burial of exposed acid-forming refuse;

(3) Correction of defective backfills;

(4) Diversion of streams seeping into mines;

(5) Regulation of stream flows; and

(6) Treatment of mine drainage.

In Water Sub-region A, Phase 1 of this program is complete in the North Branch of the Susquehanna River Basin. It is, however, incomplete in the Delaware Basin. Phase 2 is also incomplete in the North Branch Basin.

Planning studies are underway on five projects. These studies are being accomplished by: (a) the Pennsylvania Departments of Health, and Forests and Waters; and (b) the Federal Water Pollution Control Administration.

In addition, an action program is underway by the Pennsylvania Department of Mines and Mineral Industries which is partly funded by a bond issue.

One project that is presently under study is considered to have potential for mine acid pollution abatement in the North Branch of the Susquehanna River. It is described below. This project has been given an emergency priority rating by the Pennsylvania State Planning Board. It ranks first of seventeen priority projects recommended for immediate consideration in the Pennsylvania State Supplement to the Report for Development of Water Resources in Appalachia.

Lackawanna River - Susquehanna River Mine Drainage Abatement, Subsidence Prevention, and Flood Protection. This is a program to alleviate critical conditions which have been created by the cessation of pumping that has accompanied the closing of anthracite mines in the Lackawanna and Luzerne Valleys. As the pumping ceased, mines have become flooded and ground water levels have risen. The situation has been aggravated by subsidence, which further raises ground water levels.

The rising level of ground water has been blamed for: (a) subsidence conditions in Plymouth, after the Nottingham-Buttonwood Mine closed; (b) basement flooding and minor subsidence in Kingston in the summer of 1968; and (c) the recent loss of two homes (and threat to two blocks of other homes) in the Austin Avenue area of Wilkes-Barre. Cessation of pumping by the Blue Coal Company will allow water to move freely through the entire Wyoming Valley, thereby flooding mines on both sides of the Susquehanna River from Forty-Fort to Nanticoke.

Among the purposes of this program are the protection from flooding and subsidence of an undetermined number of homes and businesses in the 9.05 square miles of the densely settled Wyoming Valley flood plain. In addition, pumping and treatment of acid mine water in the Old Forge and Duryea areas of the Lackawanna River Basin will remove 66 tons of acid

and 31 tons of iron pollutants daily. Approximately equal amounts will be prevented from entering the North Branch system in the Wilkes-Barre area. Accordingly, almost 200 tons of pollutants daily will be kept from the river.

Once water quality is improved, the North Branch of the Susquehanna will become useful for industrial and municipal needs.*/ The Scranton-Wilkes-Barre area has been selected as a primary potential growth center. Further job losses from these mine flooding conditions could reverse this growth trend if subsidence caused relocation of large employers.

The project would improve water used for municipal supplies in Danville, and for processing by Merck and Company on the river opposite Danville. Downstream communities will benefit by offering a higher grade of water to prospective industries. Water quality will be improved for cooling needs of the United Gas Improvement Company power plant at Hunlock Creek in Luzerne County.

Water of the North Branch Basin will be better adapted to fishing and wildlife propagation. Recreation opportunities, especially boating, will be enhanced, bringing business opportunities to serve the needs of boaters.

Further details regarding this engineering project are contained in the Pennsylvania State Supplement to the Report for Development of Water Resources in Appalachia.

Reclamation of Mine Disturbed Lands. Treat by reclamation measures those portions of the 50,100 acres of mine disturbed lands identified in the USDA Program recommendations in Appendix A, which can furnish economical sites for commercial and industrial expansion, for residential or other urban uses, or for agricultural or forest uses.

The Susquehanna River Basin Mine Drainage Study. This is an authorized Corps of Engineers study for the purpose of consolidating all data available from previous studies and developing a detailed plan to eliminate mine drainage pollution of streams within the Susquehanna Basin. The need for a plan to eliminate the problems arising from acid mine drainage has long been recognized, and previous studies have clearly identified the scope and magnitude of the problem and the sources of acid pollution. The Susquehanna River Basin

---

*/ The Federal Water Pollution Control Administration gave pollution abatement in the Berwick to Pittston section of the North Branch the highest number of "benefit points," indicating that the need is critical, and action will be most beneficial.

Mine Drainage Study will identify the problem areas in detail, determine the specific sources of mine drainage pollution, and will study and identify measures which will reduce, and, in some locations, virtually eliminate the problem. A detailed plan for prevention and elimination of the mine drainage problem throughout the Susquehanna Basin will be formulated. The objective of the plan will be to restore presently acid streams to a higher quality which will increase the use of these streams for municipal and industrial water supply, and also increase their value for fish and wildlife and water contract recreation.

Accelerated Land Treatment Measures. The U. S. Department of Agriculture recommends the acceleration of land treatment and management programs on privately owned lands to meet the most urgent needs by 1980. This acceleration will provide continued production of food and fiber and reduction of floodwater, erosion, and sediment damages. The recommended practices will also increase outdoor recreational opportunities and improve the water and environmental quality of the Sub-region. Priority will be given to critically eroding areas and the drainage areas above the recommended and installed water resource developments of the State, Corps of Engineers and others to improve their efficiency and useful life. Land treatment measures are proposed to:

a. Adequately treat and protect 640 acres of cropland, improve 7,080 acres of pasture, and establish 2,830 acres of new pasture planting.

b. Stabilize critical eroding areas on 410 acres of roadbanks and 50,100 acres of surface-mined areas.

c. Improve private forest and woodland by 3,000 acres of tree planting, 120 acres of erosion control, 1,800 acres of harvest cutting, 6,800 acres of hydrologic stand improvement, and 1,800 acres of woodland grasing control.

d. Increase recreational opportunities and improve fish and widllife habitat by construction of 22 farm ponds, management of 70 farm ponds for fish production, revegetation of 920 acres, construction of 57 miles of recreation access roads, development of 9,010 acres of wildlife habitat, plan wildlife habitat preservation for 52,410 acres, and develop 2,080 acres of picnic and 800 acres of camping areas.

e. Develop 2,060 basic conservation plans and 450 forest and woodland management plans.

Element B - Structural Measures

Projects in operation or expected to be in place by 1980:

Corps of Engineers

Prompton Reservoir (modified to increase water supply and recreation)
Jadwin Dam
Tocks Island Reservoir and Delaware Water Gap National Recreation Area (NPS)
Aquashicola Reservoir
Beltzville Reservoir
Walter Reservoir (modified to increase water supply and recreation)
Stillwater Reservoir
Aylesworth Reservoir

Local Protection Projects at:

Stroudsburg - East Stroudsburg
Scranton

Local Protection Projects at: (cont'd)

Swoyersville and Forty Fort
Wilkes-Barre, Hanover Township
Kingston, Edwardsville
Plymouth

Pennsylvania Power & Light Company

Lake Wallenpaupack

Upstream Watershed Projects (USDA)

Brodhead Creek
Green - Dreher Tribs.
Lackawaxen Tribs.
Little Schuylkill River
Mauch Chunk Creek

Projects Recommended for Authorization

Tamaqua Local Protection Project

II - Implementation Within Five Years

For continued planning:

Local Protection at Wilkes-Barre and Kingston (CE)
Upstream alternatives considered in Susquehanna Comprehensive Survey (CE & USDA)

Nescopeck Creek Watershed (USDA) - Accelerated Project Study
Wyoming and West Wyoming Flood Protection (CE & Pennsylvania)
Plymouth Local Flood Protection from Wadham Creek (CE & Pennsylvania)
Swoyersville & Forty-Fort Extension of Local Protection (CE & Pennsylvania)
Small Flood Control Structures recommended in Delaware (CE & SCS)

III - Implementation May Be Deferred Five Years or Longer

Element C - Non-Structural Measures

Flood Plain Information Studies at:

Scranton
Wilkes-Barre and vicinity
Jim Thorpe-Lehighton
Stroudsburg-East Stroudsburg
Honesdale

Element D - Preservation of Quality of Ground and Surface Water

SECTION V - PARTICIPANTS IN SHAPING AND EXECUTING THE PLAN

12. SHAPING THE PLAN

Federal Agencies

Evolution of the plan for water resources development program in the interest of improving economic growth potential in Water Sub-region A involves the direct cooperation of Federal, state and county planning agencies. Federal agencies participating in plan development by providing input data and review capability include:

(1) Appalachian Regional Commission

(2) Department of Agriculture

- Economic Research Service
- Forest Service
- Soil Conservation Service

(3) Department of the Army

- Corps of Engineers
  - Baltimore District
  - Philadelphia District
- Office of Appalachian Studies

(4) Department of Commerce

- Office of Business Economics

(5) Department of Health, Education and Welfare

(6) Department of Housing and Urban Development

(7) Department of the Interior

- Federal Water Pollution Control Administration
- Bureau of Outdoor Recreation
- National Park Service
- Bureau of Sport Fisheries and Wildlife
- Bureau of Mines
- U.S. Geological Survey

Of these agencies, those concerned directly with project planning and construction are the Corps of Engineers, and the Soil Conservation Service.

Non-Federal Agencies

Non-Federal agencies contributing necessary data, review capability, and judgment as to plan compatibility with State and Local Development District planning include:

(1) The Commonwealth of Pennsylvania State Planning Board: and the Departments of: Commerce, Forests and Waters, Health, and Mines and Mineral Industries.

(2) The Northeastern Pennsylvania Local Development District;

(3) Planning and Zoning Commissions in Carbon, Lackawanna, Luzerne, Monroe, Schuylkill and Wayne Counties.

(4) The Delaware River Basin Commission.

(5) The Tocks Island Regional Advisory Council.

In addition, information used in preparation of the plan was obtained from previous studies by the Delaware River Basin Commission.

13. EXECUTING THE PLAN

Responsibilities

A firm division of responsibility between Federal and non-Federal agencies for execution of the plan cannot be made until it has been ascertained which of the proposed projects are to be included in the overall plan for water resources development in the Appalachian Region. Generally, for those projects recommended for construction under existing legislative authorities, Federal responsibility for completion of contract plans and specifications, award of contracts, and construction surveillance will be met by the Department of Agriculture, Soil Conservation Service and the U.S. Army Corps of Engineers.

Non-Federal agencies will be responsible for producing the assurances of local cooperation and cost sharing that are prescribed in separate project authorizations. Successful execution of the water resources development plan presented in this report will depend on continuing coordination of effort by the same Federal, state and local agencies that were active participants in plan development.

Federal and non-Federal responsibilities involved in implementation of the various elements of the plan of improvement for Water Sub-region A are discussed below.

Element A

Implementation of the proposed mine-land reclamation, watershed rehabilitation and mine pollution abatement program poses an

extremely complex problem. This problem involves continued coordination of effort, and division of responsibility, among many Federal, state and local planning and action agencies. One Federal agency, with both planning and construction capability, should be assigned the responsibility for coordinating the efforts of all agencies and individuals contributing to the mission. It is considered this can be accomplished most efficiently and effectively by expanding the Susquehanna River Basin Mine Drainage Study (authorized by a resolution of the U.S. Senate Committee on Public Works, adopted 14 April 1964, to include the Schuylkill and Lehigh Watersheds of the Delaware River Basin. This study could then consider the mine-disturbed land reclamation, watershed rehabilitation and mine pollution abatement problems of the entire Anthracite region of Appalachia and produce a cohesive, integrated plan, with establishment of appropriate priorities in which the Commonwealth of Pennsylvania should be intimately involved.

A suggested procedure is outlined as follows:

The U.S. Army Corps of Engineers, in cooperation with the U.S. Department of Agriculture, Commerce, Interior, Appalachian Regional Commission, and Health, Education and Welfare, and the Commonwealth of Pennsylvania, should be assigned responsibility for the:

Collection, consolidation and evaluation of all existing data, plans, and proposals concerning restoration of mine-scarred lands, elimination of flood hazards, cessation of subsidence, and abatement of mine drainage pollution throughout the Anthracite region of Appalachia.

Formulation, on the basis of Appalachian program planning criteria, of the optimum plan for realization of planning goals. In formulation of the optimum plan, all alternative solutions to problems in specific areas are to be considered. Potential projects, determined to be components of the optimum plan, are to be described in survey scope detail;

Coordination of the optimum plan of improvement with the Appalachian Regional Commission. The report should include: (a) a complete economic analysis of the plan in accordance with Appalachian evaluation procedures; and (b) recommendations for cost sharing in accordance

with applicable legislation and guidance. Full consideration should be given to the economic capabilities of the affected areas for participation in cost sharing. Responsibilities of Federal, state and local interests for construction of the plan should be spelled out in detail.

Consolidation and evaluation of all available data and plans, and completion of additional detailed studies necessary to issue an Interim Report on the Lackawanna River and Susquehanna River Mine Drainage Abatement, Subsidence Prevention and Flood Protection Program being developed by the Commonwealth of Pennsylvania. The interim report on that plan should be completed within one year after the study is authorized.

Program recommendations covering acceleration of land treatment measures will be carried out under various existing programs of the U. S. Department of Agriculture in cooperation with landowners and users, and local units of government and state agencies. USDA agencies directly involved include Agricultural Stabilization and Conservation Service, Farmers Home Administration, Forest Service, and Soil Conservation Service. Local governmental units and state agencies include towns, cities, counties, soil and water conservation districts, State Departments of Agriculture, and Forests and Waters, and State Game and Fish Commissions.

Element B

Implementation of this element of the plan involves continued coordination between the U.S. Army Corps of Engineers, the Soil Conservation Service and the Pennsylvania State Planning Board, as well as other state agencies for the duration of the Appalachian Development Program. As changes occur in the state investment plan affecting priorities of various program elements, scheduling of authorized water resources projects for construction is subject to change. Annual appraisals and re-evaluations of the effects that all the various economic development programs are having on the economy of Water Sub-region A may indicate the need for significant modification of some authorized projects prior to construction, in order to maximize economic benefits for the Water Sub-region.

Completion of detailed structural designs, coordination with local interests and eventual construction of the Project for Local Flood Protection at Tamaqua, if authorized by Congress, should be the responsibility of the Corps of Engineers.

Study of the projects for Restoration of Deer Lake, and Restoration of Lake No. 1, Tobyhanna, indicates that these two projects have potential for satisfying obvious and urgent water-related needs. Both would also have a significant impact on the local economy. If Federal interest in these essentially single-purpose recreation projects is limited to 50 percent of the costs, as required under Public Law 87-874, it is unlikely that local interests could afford to furnish their share without severely overtaxing their sources of revenue. Consequently, if these two projects are found to be compatible with the state-wide comprehensive plan for outdoor recreation, alternative means of funding should be investigated, such as the Land and Water Conservation Act of 1965, or other legislative authorities.

Element C

Implementation of flood plain management studies are undertaken by the Corps of Engineers at the request of local interests, usually planning agencies representing municipalities or areas for which the information is desired.

Element D

Expeditious completion of sewage disposal systems and implementation of building codes and zoning ordinances for the purpose of improving and preserving the quality of ground and surface water is primarily a responsibility of state, county and municipal planning agencies. Coordination of local planning efforts between adjacent communities and counties will be required. Federal assistance in planning and funding of approved projects will continue to be primarily the responsibilities of various agencies of the Departments of Agriculture and Interior.

Since needs for all elements of the plan are existing now, and benefits can accrue to the area from the beginning of construction, maximum impact on the economy of the area can be obtained by expediting authorization of the necessary studies.

Coordination

Introduction

The question of how traditional statutory requirements for local cooperation and cost sharing will be applied to Appalachian projects has crucial bearing on the future course of the water resources development program for Water Sub-region A.

Many programs are evolving in the Appalachian Region that, in a sense, are in competition for local cooperation and cost sharing. In many cases, rigid adherence to traditional requirements could result

in confronting local authorities with the question of whether to bankrupt themselves with development programs, or forego the opportunity for fulfilling some urgent water-related need that could place constraints on their future economic growth.

Recent guidance concerning the problem indicates that identification of the appropriate degree of Federal interest in projects that are clearly established as serving the defined Appalachian objectives will be a second-stage consideration; appropriate changes in traditional levels of Federal interest may be a prior necessity.

Requirements for Federal Projects or Federally Assisted Projects

Corps of Engineers. Local cooperation requirements for the Local Flood Protection project at Tamaqua, if authorized for construction under the Flood Control Act of 1936, will be:

(1) To provide without cost to the Federal Government all lands, easements, and rights-of-way necessary for construction of the project;

(2) To hold and save the Federal government free from damages due to the construction works; and

(3) To maintain and operate the project after completion in accordance with regulations prescribed by the Secretary of the Army.

Department of Agriculture. Many natural resource-oriented programs and services administered by the U.S. Department of Agriculture require local initiation, participation, and cooperation. Most of the programs are aimed at assisting landowners, operators, and local groups in planning and installing an integrated system of land use, conservation treatment, and development in harmony with the capability and needs of the land.

For some programs, local citizens initiate, direct and assist in project planning. Local groups are also responsible for most of the costs of the programs supplemented by technical and financial assistance of the Federal government.

The principal USDA-assisted programs recommended for Water Subregion A are the Upstream Watershed Program (Public Law 566), the Resource Conservation and Development Program (Public Law 87-703), and cooperative state and private forestry programs. The first two of these programs must be initiated by the people living in the area. Each program has many other requirements for local participation and cooperation.

Requirements for Non-Federal Projects

In 1965, the Pennsylvania State Legislature asserted in the Clean Streams Law that:

> It is the objective of the Clean Streams Law not only to prevent further pollution of the waters of the Commonwealth, but also to reclaim and restore to a clean, unpolluted condition every stream in Pennsylvania that is presently polluted ..... prevention and elimination of water pollution is recognized as being directly related to the economic future of the Commonwealth.

Responding to its responsibilities for urban water pollution, the Pennsylvania Department of Health has developed Pennsylvania's Ten Year Mine Drainage Pollution Abatement Program for Abandoned Mines. This program is being executed in cooperation with the Federal Water Pollution Control Administration, the Department of Mines and Mineral Industries and Federal agencies.

In 1967, Pennsylvania voters approved a $500 million Land and Water Conservation and Reclamation Fund, $150 million of which will be allocated to the Department of Mines and Mineral Industries for abatement of pollution from abandoned mines.

Additional policies affecting mine acid drainage have been instituted by the Pennsylvania State Sanitary Water Board. The Board regulates discharges from working mines, both open-pit and underground. New mines may be opened if operators prevent pollution. Open-pit mines must be restored so that exposed coal seams do not contribute acid drainage to surface and sub-surface waters.

Pollution by mine acid, then, is being attacked through several policies, both corrective and preventive. Basic responsibility for these programs is delegated to the Pennsylvania Sanitary Water Board, the Pennsylvania Department of Health and the Pennsylvania Department of Mines and Mineral Industries.

Municipal and industrial pollution is second only to mine acid as a source of contamination in Water Sub-region A. Pennsylvania legislation, such as the Purity of Waters Act (1903) and the Clean Streams Law (1937 as amended to 1965) establish state control over both municipal and industrial wastes. The Pennsylvania Sanitary Water Board is responsible for enforcing this law by issuing orders for pollution abatement.

The dual problems of industrial pollution and pure water requirements of industrial processes are difficult water policy problems.

Those industries discharging wastes into the streams of the Water Subregion are obligated to meet water quality standards established by the Pennsylvania Sanitary Water Board. Compliance is often expensive, and may put an industry at a competitive disadvantage, if other firms can evade the costs of meeting similar standards.

Reservoir pollution, according to the Pennsylvania Health Department, is an area in which federal policy is desirable. The Department recommends that adequate planning should be conducted, and funds should be made available as a part of the Appalachian program to provide sewage facilities at all Federal reservoirs having recreation included as one of their uses.*/

Silt pollution abatement resulting from construction of highways, dams and other improvements is also the subject of Commonwealth policy. This policy takes the form of cooperation between the Pennsylvania Department of Health and the agency responsible for construction.

Laws and regulations governing purity, protection of watersheds, water withdrawal from streams and similar matters have long been established. The Pennsylvania Sanitary Water Board is concerned with the quality of these water supplies. The Pennsylvania Water and Power Resources Board regulates water quantities that may be withdrawn from the state's rivers and streams. Interstate compacts are being instituted as well to regulate withdrawals from interstate rivers and streams.**/

Navigation is a concern not only of the Corps of Engineers, which is charged with maintaining channels and locks on certain rivers, but also the Pennsylvania Fish Commission, which regulates boating on the Commonwealth's rivers and streams.

Impoundment of water is under the jurisdiction of the Water and Power Resources Board of the Pennsylvania Department of Forests and Waters. Impoundment occurs for many different reasons, among them, flood control, navigation, water supply, power, low flow augmentation, erosion control, and wildlife propagation. Other agencies are involved depending on the particular reasons for the impoundment.

When flood control is the goal, the Army Corps of Engineers often undertakes the project, and coordinates its activities with the

---

*/ Already implemented at Corps reservoirs under Executive Order. Design criteria of the appropriate states, which have been approved by FWPCA, are met.

**/ These policies are discussed in detail in the Pennsylvania Water Supplement to Development of Water Resources in Appalachia, pp. 21-26.

AD-A041 387 CORPS OF ENGINEERS CINCINNATI OHIO F/G 8/6
DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. MAIN REPORT. PART--ETC(U)
NOV 69

UNCLASSIFIED NL

3 OF 7
AD
A041387

Pennsylvania Department of Forests and Waters. The Pennsylvania Department of Forests and Waters also has an active flood control program. It coordinates with other appropriate state departments, including Health, Commerce, Highways, Mines and Mineral Industries, and the Fish and Game Commissions, the Soil and Water Conservation Commission, the General State Authority and the State Planning Board.

Impoundment for water supply is regulated by the Pennsylvania Water and Power Resources Board with approvals from the Pennsylvania Secretary of Health and the Pennsylvania Public Utilities Commission.

Impoundment for conservation needs, and to prevent soil erosion, is undertaken by the Pennsylvania State Soil and Water Conservation Commission through soil and water conservation districts. Such watershed projects involve water storage for agricultural and domestic use. Similarly, the Pennsylvania Department of Forests and Waters manages state forest lands for watershed protection and runoff retardation.

Impoundment for propagation of wildlife is a goal of the Fish and Game Commissions. The Fish Commission constructs dams to impound water for fishing lakes. The Game Commission impounds water for waterfowl.

Advance acquisition of reservoir sites is a part of the responsibility of the Pennsylvania Department of Forests and Waters. Under the Commonwealth's Project 70 program, land for future reservoirs may be acquired. This power permits acquisition of land which might later be prohibitively expensive.

Use of water for recreation activities receives high priority among Pennsylvania Commonwealth agencies, particularly the Department of Forests and Waters which plans and operates the state park system. A Departmental goal is a network of state parks serving all urban and rural areas. Most of these are planned around an existing stream or a reservoir built as part of the development. The Game and Fish Commissions, as already mentioned, develop impoundments for recreation functions. Local units of government are authorized by state law to fund similar recreation uses.

SECTION VI - DISCUSSION AND CONCLUSIONS

14. DISCUSSION

Comprehensive review of water resources needs and developmental potential in Water Sub-region A was undertaken with a view to:

a. defining all current water-related problems which could be considered significant deterrents to economic growth or welfare in the Water Sub-region; and

b. formulating a comprehensive plan of improvement, with projects scoped to:

(1) produce the maximum in benefits from the various project purposes; and

(2) provide an optimal means for stimulating and sustaining economic growth in the area.

The basic considerations governing project formulation were:

a. The intent of Congress as expressed in Sections 2, 205 and 206 of the Appalachian Regional Development Act of 1965, Public Law 89-4;

b. The desires of local interests;

c. Adherence to sound engineering judgment and construction principles; and

d. Development of a plan of improvement that would incorporate to the fullest practicable extent the plans and programs of all interested agencies, Federal, state and local, into a balanced program for achieving basic objectives with minimum investment.

Improvements that involve Federal participation, and that appear to warrant initial priority for accomplishment, include:

a. Expansion of the presently authorized Susquehanna River Mine Drainage Study to include the Schuylkill and Lehigh River Watersheds, with a view to developing the optimum plan for solving the problems of mine-disturbed land reclamation, watershed rehabilitation, mine drainage, and related pollution in the Anthracite region of the Susquehanna and Delaware River Basins. Emphasis should be placed on completion of an interim report on the Lackawanna River and Susquehanna River Mine Drainage Abatement, Subsidence Prevention and Flood Protection Program as soon as possible.

b. Federal programs for acceleration of land treatment measures and drainage areas above completed and planned water resource developments in the sub-region; and

c. A local flood protection project for Tamaqua, Schuylkill County, Pennsylvania.

Two other projects that would fulfill important water-related needs for outdoor recreation in the area, but for which the degree of Federal participation warranted has not been defined, are:

a. Restoration of Deer Lake, Schuylkill County, Pennsylvania; and

b. Restoration of Lake No. 1 of Tobyhanna, Monroe County, Pennsylvania.

There are four local protection projects in Lackawanna and Luzerne Counties for which preliminary planning has been accomplished by the State of Pennslylvania. These appear to be economically justified, but require further detailed study in order to determine their interrelationship with other potential projects.

Projects may result from the comprehensive survey investigation and report on the rehabilitation of the mine-scarred portions of the Anthracite Counties. Projects in this area would have the greatest potential for sparking and sustaining the desired type of industrial growth in the Water Sub-region, and should be assigned the highest priority.

Although there has been significant growth in the light manufacturing industry in this section of the Water Sub-region since 1950, this growth has been concentrated in the fabrics and apparel manufacturing sector. This sector, in turn, has been able to capitalize on the availability of a high percentage of relatively unskilled female labor, and is apparently not sensitive to the existing adverse environmental conditions. Economic studies, however, indicate that this sector will not continue to expand in the area. Consequently, a means must be found to induce into the area higher paying light manufacturing industries that do have potential for future expansion. Economic and environmental studies show that this type of industry is sensitive to many factors in making locational decisions, such as quality and quantity of available labor force, quality of transportation facilities, proximity to raw materials and markets, availability of building sites with adequate utilities, and the environmental quality of urban and rural surroundings.

It is not possible to ascertain the exact priorities that individual industrial executives give to factors such as these in making locational decisions. Yet, with regional competition for attracting new industry as keen as it is, a significant deficiency in any ammenity such as those

above could result in an unfavorable decision on the part of an otherwise interested industry. Thus, timely completion of a comprehensive survey investigation and subsequent construction program is of importance to continued economic growth and development in Water Sub-region A. Such a program is essential to insure the realization of maximum benefits from other complementary investment programs for purposes of improving the labor force, expanding transportation facilities, assuring availability of improved industrial sites and removal of urban and rural blight.

Acceleration of land treatment measures in the five upstream watershed projects expected to be completed by 1980 warrants implementation at the earliest date. Because most of these watershed projects are located in the Pocono Counties, improvements would tend to reinforce the existing base for the growing outdoor recreation services industry.

An accelerated project study of the Nescopeck Creek Upstream Watershed sould be made in the near future. If the detailed findings substantiate the preliminary conclusions reached by the U. S. Department of Agriculture (See Appendix A), the goal should be project implementation within 20 years.

Detailed study of the Local Flood Protection project at Tamaqua, has shown that this project is economically justified on the basis of user benefits alone. It would warrant authorization for construction under considerations other than Appalachian redevelopment. Economic analysis, however, in accordance with Appalachian developmental objectives, serves to underscore the feasibility of prompt implementation of this project. In addition to direct benefits resulting from flood damage prevention, completion of the project would result in increased practicality of undertaking a needed urban rehabilitation and redevelopment program in portions of the Tamaqua business district. The project has the enthusiastic support of local citizens who have also been active in promoting other development programs designed to revitalize the economy of the community and surrounding area.

No new projects are recommended at this time for implementation of Element D of the plan of improvement. The importance of the requirement for prompt and coordinated action on the part of local planning agencies to execute plans for water and waste disposal systems, and to enact the zoning ordinances and building codes necessary for their effective operation, cannot be overemphasized. Large public investments in other complementary development programs can be rendered ineffective by failure to safeguard sources of surface and groundwater from pollution due to improperly handled wastes from rapidly expanding residential, commercial and industrial developments throughout the Water Sub-region.

15. CONCLUSIONS

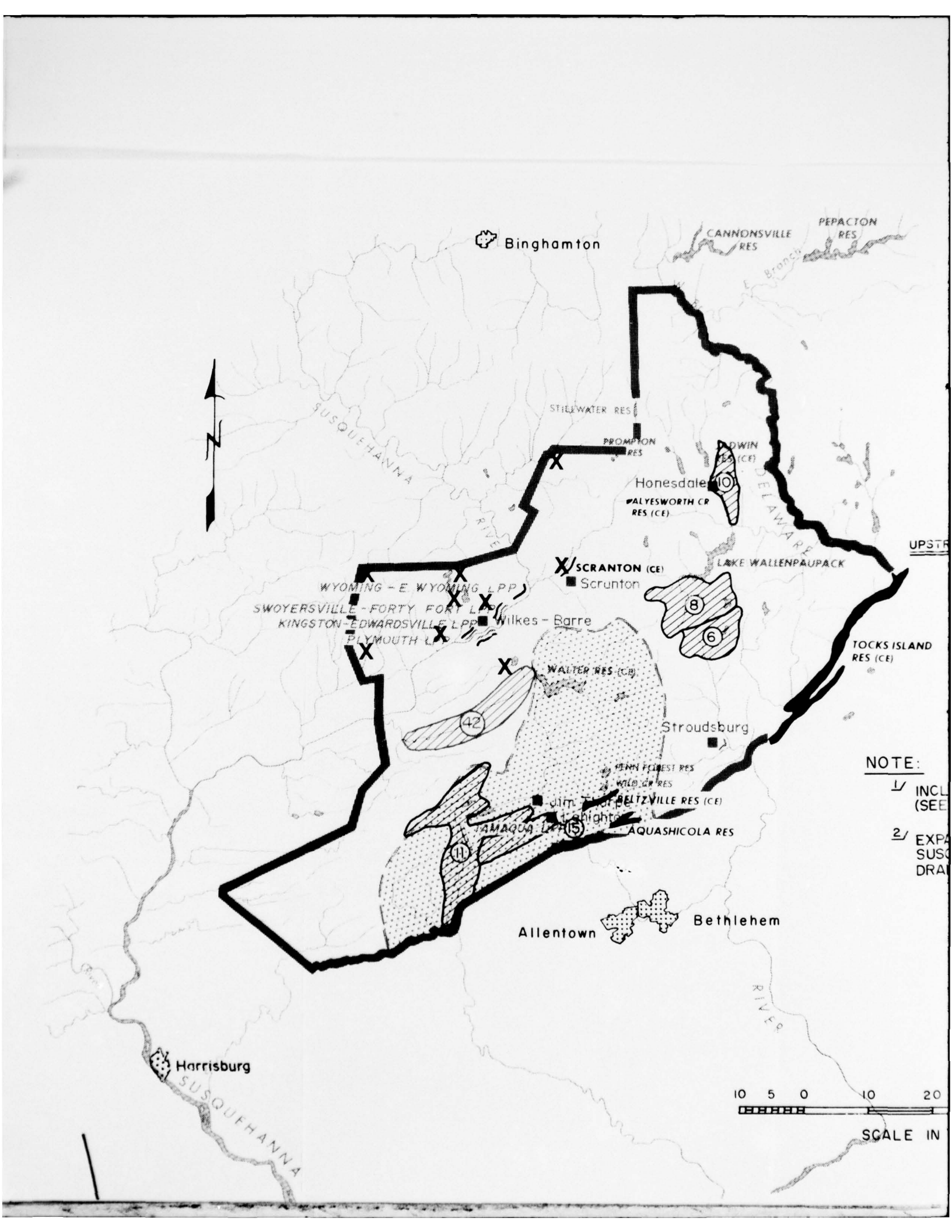
As a result of the study and preceding discussions it is concluded that:

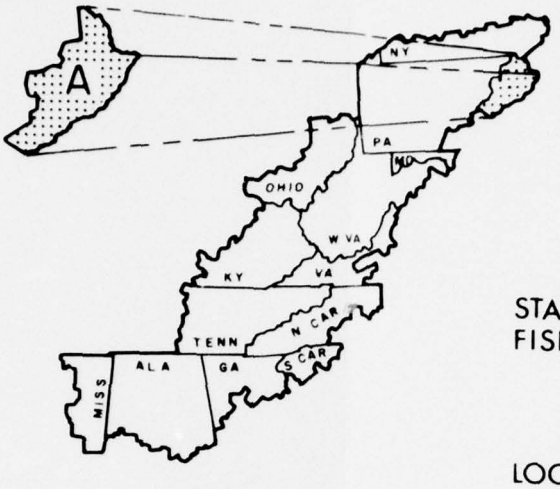
a. The development of the water resources of Water Sub-region A is an essential part of any investment program to foster and sustain economic growth in the Water Sub-region;

b. The implementation of the four-element plan of development described above is essential for full realization of physical and economic developmental goals in the Water Sub-region;

c. The comprehensive study of the Anthracite Region of Water Sub-regions A and B and provision of Local Protection project at Tamaqua, are essential parts of the plan for water development of Water Sub-region A. They are responsive to Appalachian objectives, and should be implemented in the initial overall plan for development of the Appalachian Region;

d. Projects for Restoration of Deer Lake; and Restoration of Lake No. 1 at Tobyhanna, are locally responsive to Appalachian redevelopmental objectives and are economically justified. Further consideration for implementation of these projects is warranted.


Binghamton
CANNONSVILLE RES
PEPACTON RES
STILLWATER RES
PROMPTON RES
Honesdale
10
WALLENPAUPACK CR RES (CE)
LAKE WALLENPAUPACK
SCRANTON (CE)
Scranton
WYOMING - E. WYOMING LPP
SWOYERSVILLE - FORTY FORT LPP
KINGSTON - EDWARDSVILLE LPP
Wilkes - Barre
PLYMOUTH LPP
8
6
TOCKS ISLAND RES (CE)
WALTER RES (CE)
42
Stroudsburg
PENN FOREST RES
WILD CR RES
BELTZVILLE RES (CE)
Jim Thorpe
Lehighton
TAMAQUA
15
AQUASHICOLA RES
11
Allentown
Bethlehem
Harrisburg
SUSQUEHANNA
RIVER
10 5 0 10 20
SCALE IN
NOTE:
1/ INCL (SEE
2/ EXPA SUS DRA



VICINITY MAP

PEPACTON RES

TOCKS ISLAND RES (CE)

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

6. BRODHEAD CREEK
8. GREEN-DREHER
10. LACKAWAXEN TRIBUTARIES
11. LITTLE SCHUYLKILL RIVER
15. MAUCH CHUNK CREEK

FOR CONTINUING PLANNING

42. NESCOPECK

NOTE:

1/ INCLUDES EXISTING ELEMENTS (SEE FIGURE I-15 FOR DISTINCTION)

2/ EXPANSION OF PRESENTLY AUTHORIZED SUSQUEHANNA RIVER BASIN MINE DRAINAGE STUDY

5 0 10 20 30 40 50

SCALE IN MILES

STRUCTURAL

STATE RECREATION AND/OR FISHING LAKE:

X SURFACE AREA IN EXCESS OF 200 ACRES

LOCAL PROTECTION PROJECT

EXPECTED TO BE COMPLETED BY 1980

FOR CONTINUING PLANNING

UPSTREAM WATERSHED PROJECT

(6) EXISTING OR EXPECTED TO BE COMPLETED BY 1980

(42) FOR CONTINUING PLANNING

MAJOR RESERVOIR

EXISTING OR EXPECTED TO BE 1/ COMPLETED BY 1980

NON-STRUCTURAL

■ FLOOD PLAIN INFORMATION STUDY

FUTURE STUDY 2/

REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA

WATER SUB-REGION A

PLAN OF DEVELOPMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-2-97 FIGURE 2-20

2

DEVELOPMENT
OF
WATER RESOURCES
IN
APPALACHIA

MAIN REPORT
PART II
SHAPING A PLAN

CHAPTER 3 - WATER SUB-REGION B TODAY

TABLE OF CONTENTS

Par.	Subject	Page II-3-
	SECTION I - THE REGION TODAY	1
1	POLITICAL	1
2	PHYSICAL	1
	Physiography and Geology	1
	Climatology	7
	Runoff	8
	Transportation	9
3	RESOURCES DEVELOPMENT	10
	Human	10
	Minerals	18
	Lands	23
	Environmental Aspects	25
	Water Resource Development - Federal	29
	Corps of Engineers	29
	Reservoir Projects	29
	Local Protection Projects	35
	U.S. Department of Agriculture	37
	Completed Watershed	37
	Approved Watershed Projects	37
	Land Use Programs	39
	Other Water Resources Programs	39
	Water Resources Development - Non-Federal	39
	Municipal Water Supplies	42

CHAPTER 3 - WATER SUB-REGION B TODAY

TABLE OF CONTENTS
(cont'd)

Par.	Subject	Page II-3-
	SECTION II - SOCIO ECONOMIC STRUCTURE	45
4	INTRODUCTION	45
	Planning Devices	45
	Economic Characteristics	46
	Capital Availability	57
	Local Attitudes	58
5	WATER AREAS	61
	Water Area B-1	61
	State Planning Sub-region 1 and 2	61
	Binghamton-Owego-Susquehanna County Growth Center	64
	Chemung River Valley Growth Center	66
	Chenango Valley Growth Center	67
	The Cohocton River Valley-Hammondsport Growth Center	69
	The Hornell-Alfred Growth Center	69
	Ithaca-Cortland Growth Center	70
	Susquehanna Valley Growth Center	72
	Cobleskill-Schoharie Growth Center	74
	State Planning Sub-region 9	79
	Water Area B-2	83
	State Planning Sub-region 8	83
	State College (Centre County)	85
	Lock Haven (Clinton County)	87
	Sunbury-Milton (Columbia, Montour, Northumberland, Snyder and Union Counties)	88
	Lewistown (Mifflin County)	90
	Williamsport (Lycoming County)	92
	State Planning Sub-region 7	96
	Altoona (Blair County)	98
	Johnstown (Cambria County)	100

CHAPTER 3 - WATER SUB-REGION B TODAY

TABLE OF CONTENTS
(cont'd)

Par.	Subject	Page II-3-
	Water Area B-3	106
	State Planning Sub-region 37	106
	Cumberland (Allegany County)	108
	Hagerstown (Washington County)	109
	State Planning Sub-region 19	114
	Urban Centers	116
	Petersburg	117

CHAPTER 3 -- WATER SUB-REGION B TODAY

LIST OF TABLES

Table No.	Title	Page II-3-
3-1	Stream Discharge Data	8
3-2	Runoff From Major Streams Within the Region	9
3-3	Pertinent Data - Major Reservoirs	33-34
3-4	Local Protection Projects	35-36
3-5	Authorized Upstream Watershed Projects	38
3-6	Non-Federal Impoundments	40-41
3-6a	Non-Federal Local Protection Projects	41
3-7	Employment by Sectors for 1950 and 1960, State Planning Sub-region 1	77
3-8	Employment by Sectors for 1950 and 1960, State Planning Sub-region 2	78
3-9	Socio-Economic Characteristics, State Planning Sub-region 1	79
3-10	Socio-Economic Characteristics, State Planning Sub-region 2	80
3-11	Employment by Sectors for 1950 and 1960, State Planning Sub-region 9	83
3-12	Socio Economic Characteristics, State Planning Sub-region 9	84
3-13	Employment by Sectors for 1950 and 1960, State Planning Sub-region 8	96
3-14	Socio-Economic Characteristics, State Planning Sub-region 8	97
3-15	Employment by Sectors for 1950 and 1960, State Planning Sub-region 7	106
3-16	Socio-Economic Characteristics, State Planning Sub-region 7	107

LIST OF TABLES
(cont'd)

Table No.	Title	Page II-3
3-17	Employment by Sectors for 1950 and 1960, State Planning Sub-region 37	114
3-18	Socio-Economic Characteristics, State Planning Sub-region 37	115
3-19	Employment by Sectors for 1950 and 1960, State Planning Sub-region 19	120
3-20	Socio-Economic Characteristics, State Planning Sub-region 19	121

CHAPTER 3 - WATER SUB-REGION B TODAY

LIST OF FIGURES

Figure No.	Title	Page II-3-
3-1	Location Map	3
3-2	Physical Features	5
3-3	Average Precipitation	7
3-4	Highways and Airports	11
3-5	Railroads	13
3-6	Urban-Rural Population Distribution	15
3-7	Population Distribution by Age	16
3-8	Educational Attainment	17
3-9	Higher Education Facilities	19
3-10	Mining Activities	22
3-11	Scenic and Historical Sites	27
3-12	Water Resources Development	31
3-13	Planning Areas	47
3-14	Employment by Industry	50
3-15	Agricultural Sales	51
3-16	Unemployment Rates by Counties	55
3-17	Income Distribution	57
3-18	Sources of Income	58
3-19	Financial Situation	61
3-20	Population, State Planning Sub-regions 1 & 2	63

LIST OF FIGURES
(cont'd)

Figure No.	Title	Page II-3-
3-21	Urban-Rural Population Distribution, State Planning Sub-regions 1 & 2	64
3-22	Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 9	82
3-23	Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 8	86
3-24	Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 7	99
3-25	Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 17	109
3-26	Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 19	116

CHAPTER 3 - WATER SUB-REGION B TODAY

SECTION I - THE REGION TODAY

1. POLITICAL

Sub-region B, shown in Figure 3-1, includes parts of four states and encompasses 44 counties. The counties range in size from the 130 square mile Montour County, Pennsylvania, to the 1,470 square mile Delaware County, New York. They average about 650 square miles.

DISTRIBUTION OF SUB-REGION BY STATES

State	No. of Counties	Sub-region Area Percent	Sub-region Area Sq. Mi.
New York	11	29.6	8,455
Pennsylvania	22	52.7	15,035
Maryland	3	5.5	1,567
West Virginia	8	12.2	3,489
TOTAL	44	100.0	28,546

There are three Standard Metropolitan Statistical Areas within the sub-region: Altoona and Johnstown, Pennsylvania; and Binghampton, New York. Five cities, in addition to the three SMSA's, have a population between 25,000 and 100,000, including Cumberland and Hagerstown, Maryland; Elmira and Ithaca, New York; and Williamsport, Pennsylvania.

As in many parts of the country, there is a myriad of special purpose districts, in addition to the usual political subdivisions. These fall into several categories - school, flood control and drainage, conservation, electric power, planning, industrial, recreational, and many other types. The kinds and numbers of organizations, to some extent, reflect local interests and attitudes and are discussed in Section II, Paragraph 4.

2. PHYSICAL

Physiography and Geology

Sub-region B covers 28,546 square miles. The sub-region is approximately 380 miles in length along a northeast-southwest axis, and varies in width from about 50 miles in Pendleton County, West Virginia to about 170 miles in the New York State part. The sub-region includes portions of the Appalachian Plateaus, the Valley and Ridge, and the Blue Ridge physiographic provinces, as shown on Figure 3-2. The highest points in Pennsylvania, Maryland, and West Virginia are found generally along the Allegheny Front escarpment, which separates the Appalachian Plateaus from the Valley and Ridge Province. Elevations vary from 4,860 feet at Spruce

Knob, Pendleton County, West Virginia to less than 280 feet on the Potomac River in Jefferson County, West Virginia and Washington County, Maryland.

The Appalachian Plateaus portion to the west of the Front escarpment is divided into glaciated and unglaciated sections, both of which exhibit a dendritic drainage pattern. The glaciated section to the north is less rugged than the maturely dissected, non-glaciated portion. The Appalachian Plateaus reach a maximum elevation of just under 2,600 feet above mean sea level in Tioga County, Pennsylvania. Horizontal layers of sandstone, limestone, and shale characterize the plateaus. These sedimentary rocks are of the Paleozoic era, and include the Devonian, Carboniferous, and Permian systems. They are between 250 and 400 million years old.

The Valley and Ridge Province is characterized by roughly parallel ridges and valleys that trend generally in a northeast-southwest direction. The ridges range in height from 1,200 feet to over 4,800 feet above mean sea level: there is also some variation in their width. All are transected by gaps through which major rivers and smaller streams pass. There are broad valleys in the downstream reaches with meandering streams and large flood plains. Most human settlement has taken place in the valleys. In the headwaters, there are narrow valleys characterized by rather steep slopes leaving little room for the water-course to maneuver.

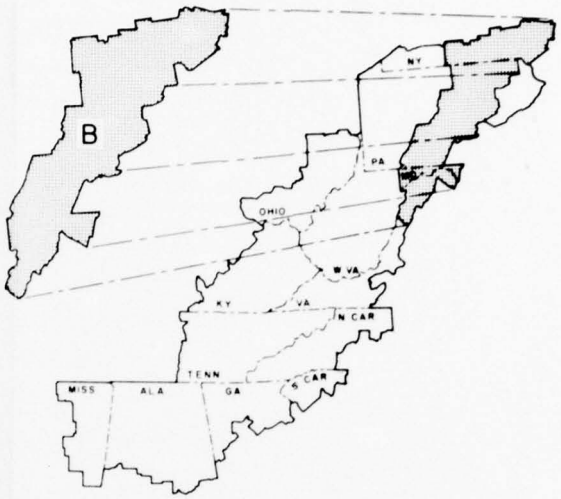
The Valley and Ridge Province is composed of intensely folded and often faulted sedimentary rocks of the Paleozoic Era that range in age from Cambrian to Devonian. The ridges are generally composed of conglomerate, shale, and sandstone, and the valleys of limestone and shale.

East of the Valley and Ridge Province are the Blue Ridge Province and the Piedmont Province, followed by the Coastal Plain. To the west, the Allegheny Plateaus gradually give way to the Central Lowlands.

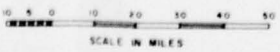
Major portions of the Susquehanna and Potomac River Basins are contained in Sub-region B. In addition, small parts of the Delaware, Genesee, Ohio, Oswego, and Hudson River Basins are included on the periphery. Drainage areas within Sub-region B are as follows:

Drainage Basin	Percent of Sub-region	Sq. Mi.
Susquehanna	65.5	18,700
Potomac	18.6	5,300
Ohio	6.3	1,800
Delaware	4.6	1,300
Oswego	2.4	700
Hudson	2.1	600
Genesee	0.4	100
TOTAL (Rounded)	100.	28,500

Buffalo
Pittsburgh
Harrisburg
Baltimore
N
NEW YORK
PENNSYLVANIA
WEST VIRGINIA
PENNSYLVANIA
OTSEGO
CHENANGO
CORTLAND
SCHOHARIE
DELAWARE
BROOME
TIOGA
CHEMUNG
SCHUYLER
TOMPKINS
STEUBEN
SUSQUEHANNA
BRADFORD
WYOMING
SULLIVAN
LYCOMING
CLINTON
COLUMBIA
UNION
SNYDER
MIFFLIN
JUNIATA
PERRY
CENTRE
HUNTINGDON
BLAIR
CAMBRIA
SOMERSET
BEDFORD
FULTON
ALLEGANY
WASHINGTON
GARRETT
MORGAN
BERKELEY
JEFFERSON
MINERAL
HAMPSHIRE
GRANT
HARDY
PENDLETON
0 5 0 10 20 30 40 50
SCALE IN MILES



VICINITY MAP



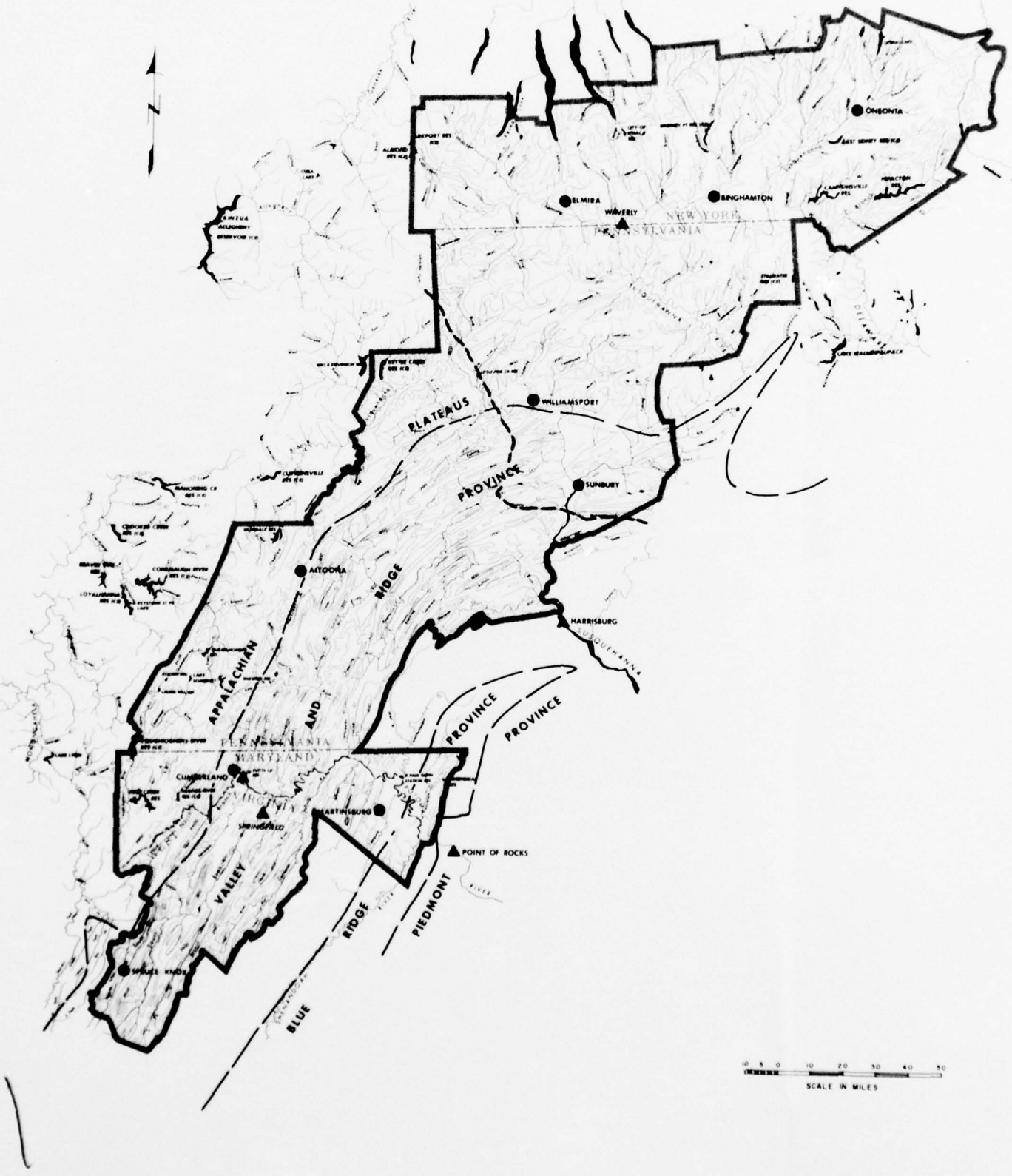
REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

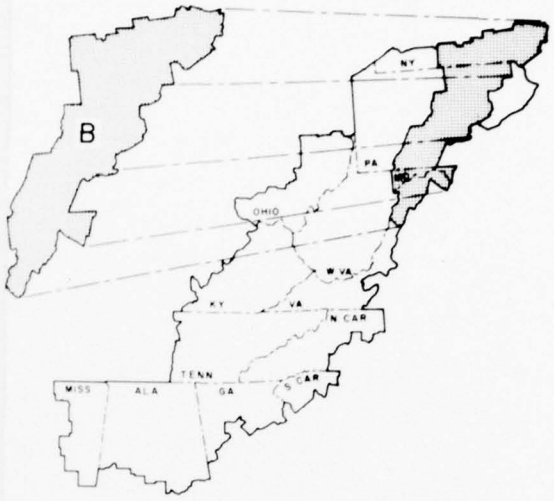
WATER SUB-REGION B

LOCATION MAP

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-3-3 **FIGURE 3-1**


ONEONTA
ELMIRA
WAVERLY
BINGHAMTON
NEW YORK
PENNSYLVANIA
WILLIAMSPORT
PLATEAUS
PROVINCE
SUNBURY
ALTOONA
RIDGE
HARRISBURG
SUSQUEHANNA
APPALACHIAN
AND
VALLEY
RIDGE
BLUE
PROVINCE
PROVINCE
PIEDMONT
PENNSYLVANIA
MARYLAND
CUMBERLAND
MARTINSBURG
POINT OF ROCKS
10 5 0 10 20 30 40 50
SCALE IN MILES

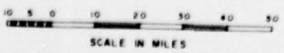


VICINITY MAP

LEGEND

- ● PRECIPITATION STATIONS
- ▲ STREAM GAGING STATIONS
- ——— PHYSIOGRAPHIC BOUNDARY
- - - - - - - - SOUTHERN LIMITS OF CENOZOIC GLACIATION

NOTE : CONTOUR INTERVAL 600 FEET .



REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION B

PHYSICAL FEATURES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-3-5 **FIGURE 3-2**

2

Climatology

The climate of Sub-region B is characterized by marked seasonal changes. There are significant temporal and geographic variations. Altitude, topography, and proximity to bodies of water affect local conditions. For example, the presence of the Finger Lakes in New York lengthens the growing season enough to make the area a major grape and wine producing area. On the other hand, a community located in one of the many valleys is likely to be subjected to early frosts as the heavier cold air settles. There have been periods of serious drought, the most recent in the period 1961 to 1966. Heavy flood damages throughout the region attest to excess runoff as a recurring problem.

Average annual rainfall ranges from 32 inches in Elmira, New York, to about 50 inches in Somerset, Pennsylvania, but can be considerably greater on mountaintops. Driest year precipitation at any station has rarely been less than 25 inches. In the wettest years, over 50 inches have soaked many areas. The greatest recorded average annual snowfall occurs at Cherry Valley, New York, where it exceeds 100 inches. The minimum annual average is 21 inches at Hagerstown, Maryland.

Precipitation is caused chiefly by the passage of frontal systems from west to east across the continent. Other less frequent heavy rainfall is from the tropical storms, hurricanes, in late summer and fall, and the local thunder storms which occur mostly in the summer months.

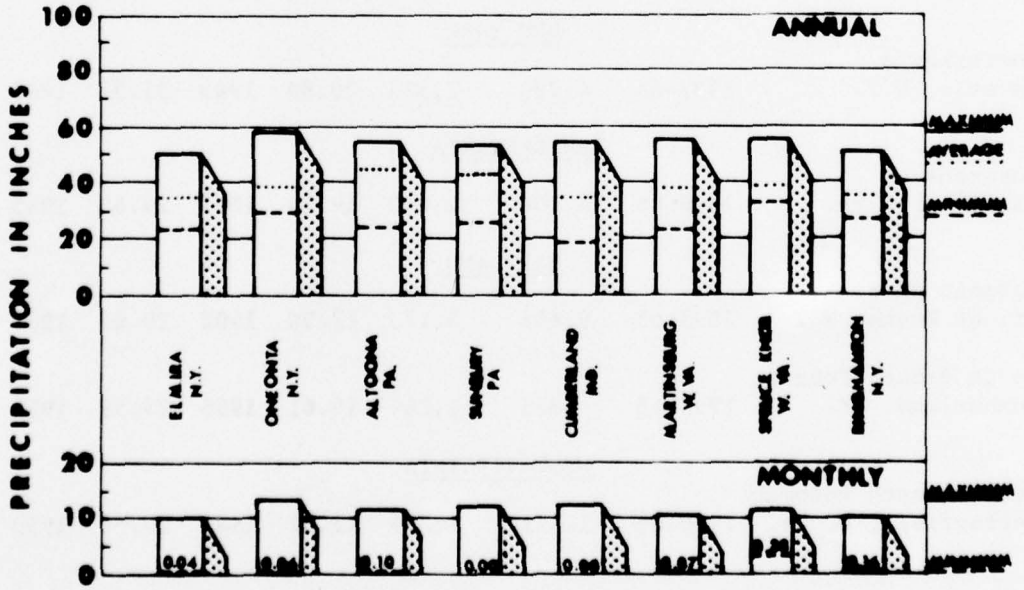


Figure 3-3 - Average Precipitation at Selected Stations, Water Sub-region B

Average January temperatures range from 21.9 degrees Fahrenheit in Cooperstown, New York, to 34.7 degrees in Picardy, Maryland. Average July temperatures range from 65.9 degrees in New Lisbon, New York, to 75.9 degrees in Keedysville, Maryland. Extreme temperatures have been observed from 105 degrees to minus 30 degrees.

The average frost-free growing season varies from less than 100 days in part of Tioga County, Pennsylvania, to 177 days at Martinsburg, West Virginia.

Runoff

Runoff from Sub-region B flows to the Atlantic ocean through the St. Lawrence, Hudson, Delaware, Susquehanna, and Potomac Rivers and to the Gulf of Mexico through the Ohio - Mississippi River system. The winter and early spring months produce the highest runoff while lowest runoff generally occurs during the summer and early fall. Representative runoffs can be obtained from the Table 3-1, giving stream discharge data using records of 25 years or longer:

TABLE 3-1
STREAM - DISCHARGE DATA

Stream and Station	Period of Record	Drainage Area sq. mi.	Average Annual cfs	Average Annual in.	Annual Runoff Max. year	Annual Runoff Max. in.	Annual Runoff Min. year	Annual Runoff Min. in.
			NEW YORK					
Susquehanna Waverly, N.Y.	1937-65	4,780	7,323	20.80	1943	31.32	1965	10.64
			PENNSYLVANIA					
Susquehanna Harrisburg, Pa.	1890-65	24,100	34,000	19.15	1891	29.63	1965	9.53
			MARYLAND					
Potomac River Pt. of Rocks, Md.	1895-65	9,651	9,173	12.90	1902	20.63	1959	6.54
North Branch Potomac Cumberland, Md.	1930-65	875	1,264	19.61	1955	25.59	1954	9.98
			WEST VIRGINIA					
South Branch Potomac Springfield, W. Va.	1928-65	1,471	1,249	11.52	1949	20.50	1959	5.71

The total regional annual water resource is generally adequate; however, its distribution in time and location does not always coincide with needs. Table 3-2 gives data for the two major drainage areas at the next downstream gaging station from where the stream leaves Sub-region B.

TABLE 3-2
RUNOFF FROM MAJOR STREAMS WITHIN THE REGION

	Average Annual MGD	Min. Day MGD
Susquehanna River Harrisburg, Pa.	21,700	1,100
Potomac River Point of Rocks, Md.	5,900	350

The largest flood on record in the lower Susquehanna and Potomac River Basins occurred in March 1936. In upstream areas of both basins, the greatest floods have occurred on different dates in different areas. In the upper Potomac Basin, hurricane induced floods in the summer and early fall have been greatest. In the upper Susquehanna Basin record floods have occurred during every season, with slightly heavier frequencies during spring due to combined snowmelt and rainfall and during summer due to thunderstorms.

Several droughts have occurred in the period of record. The lowest annual discharge in the Susquehanna River at Harrisburg occurred in 1965 and was equivalent to 9.53 inches of runoff over the drainage area. In the Potomac Basin, it occurred in 1959 with equivalent runoff of 6.54 inches. Minimum annual runoff from these two basins has been about 50 percent of the average annual.

Transportation

The major existing highway and airport facilities in Sub-region B are shown on Figure 3-4. The present system has many problems at the local and regional level. Many of the secondary routes, as well as some of the main routes, are narrow and winding. Access to some excellent recreational areas is limited. Industrial development is restricted because the roads make it difficult for heavy motor freight movement. In the Valley and Ridge Province, the highway system follows the natural routes of the valleys and the gaps in the ridges, lengthening travel time.

Although solutions to many of the sub-region's transportation problems are underway, a few sections with adequate connections already exist, particularly along the Pennsylvania Turnpike, and locations where sections of U.S. Routes 220, 11, 15, 22, 522, 40, 50, and New York Route 17 have already been improved, and where Interstates 80, 81, and 70 have been completed.

Numerous airports in the sub-region provide trunk, secondary, unclassified, and general aviation services. The larger airport locations maintaining trunk service are Cumberland and Hagerstown, Maryland; Binghamton, Elmira, and Ithaca, New York; Johnstown, Phillipsburg, and Williamsport, Pennsylvania; and Martinsburg, West Virginia.

There are 125 smaller airports handling secondary and unclassified traffic. Of these, 101 are privately owned, although all but a few are open to the public. The secondary and unclassified airports range in size from small dirt landing strips capable of handling only light single-engine aircraft, to large well-equipped, heavily-trafficked centers, able to serve business and short-range commercial jets. Eighty-two of these airports are in Pennsylvania, followed by New York with thirty-one, West Virginia with eight, and Maryland with four. The present system is in need of considerable improvement to meet present and future needs.

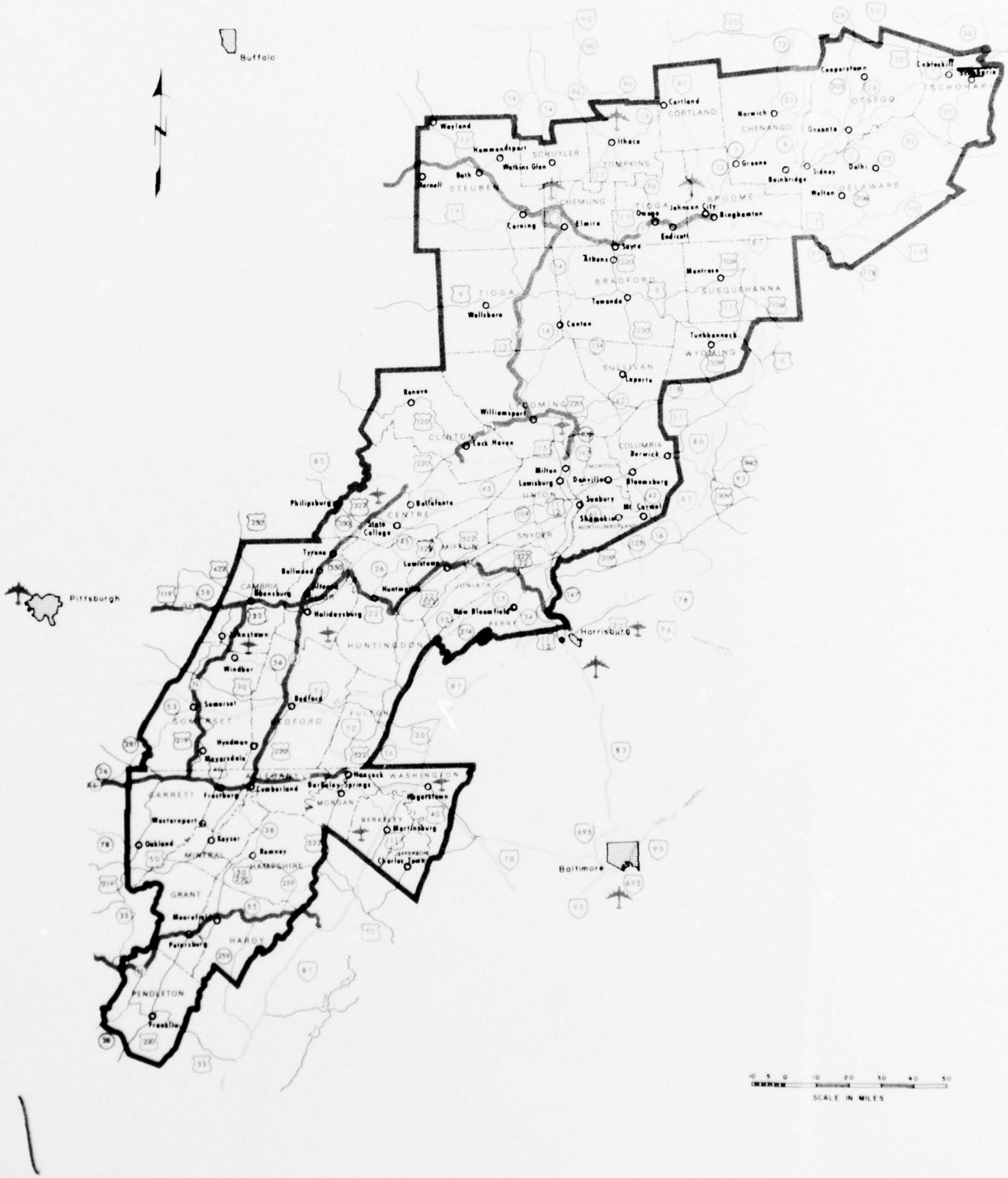
The dense, well-established railroad network which exists in the sub-region is generally adequate (see Figure 3-5 on Page 3-13). These generally follow the river valleys, and are subjected to flooding. The Penn-Central Railroad is the largest road operating. Other major companies include the Baltimore and Ohio Railroad, Western Maryland Railway, Lehigh Valley Railroad, Erie-Lackawanna Railroad, Delaware and Hudson Railroad, Reading Company, and Norfolk and Western Railroad. Small companies serving this area are operated, in many cases, by mining or steel companies to shuttle raw materials. Others are simply independent lines, or lines owned in part or whole by the larger railroad companies.

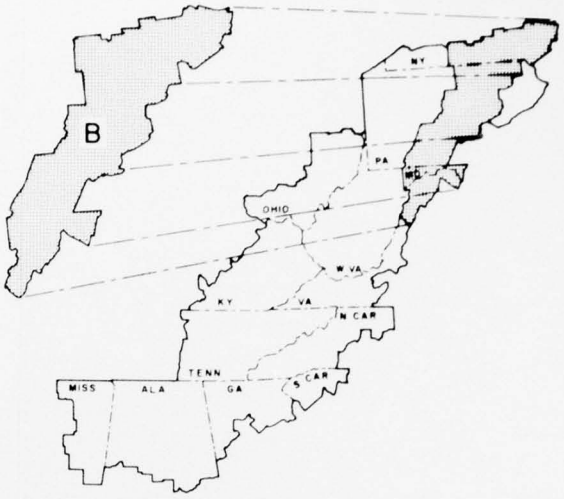
The only commercial water traffic in the sub-region occurs in Cayuga and Seneca Lakes, which have canal connections to the New York State Barge Canal. There are remnants of canals that followed some of the rivers that were used before the railroads were built; but these have been abandoned for many years. A demand for commercial waterborne transportation has not developed because of competition provided by rail systems and limited transport of bulk materials.

3. RESOURCES DEVELOPMENT

Human

The 1960 population of sub-region B was 2.24 million, about 1.2 percent of the United States. The population distribution is as follows:


Buffalo
Pittsburgh
Harrisburg
Baltimore
Cortland
Norwich
Oneonta
Cooperstown
Cobleskill
Schoharie
Otsego
Chenango
Delaware
Sidney
Delhi
Bainbridge
Walton
Binghamton
Johnson City
Endicott
Owego
Ithaca
Waverly
Hammondsport
Watkins Glen
Bath
Corning
Elmira
Sayre
Athens
Towanda
Montrose
Susquehanna
Wyoming
Tunkhannock
Wellsboro
Canton
Laporte
Renovo
Williamsport
Lock Haven
Milton
Lewisburg
Danville
Bloomsburg
Berwick
Sunbury
Mt. Carmel
Shamokin
Philipsburg
Bellefonte
State College
Tyrone
Bellwood
Hollidaysburg
Huntingdon
Lewistown
New Bloomfield
Altoona
Johnstown
Windber
Somerset
Bedford
Hyndman
Cumberland
Frostburg
Hancock
Bakers Springs
Hagerstown
Martinsburg
Charlestown
Westernport
Oakland
Keyser
Romney
Moorefield
Petersburg
Franklin
Pendleton
Grant
Hardy
Hampshire
Mineral
Garrett
Allegany
Washington
Berkeley
Morgan
Fulton
Juniata
Snyder
Union
Centre
Clinton
Columbia
Montour
Lycoming
Tioga
Bradford
Susquehanna
Schuyler
Tompkins
Chemung
Steuben
Broome
Delaware
Cortland
Otsego
Schoharie
N
SCALE IN MILES



VICINITY MAP

LEGEND

- Interstate Highway
- Federal Highway
- State Highway
- Appalachian Corridor
- Includes Jet Service
- Scheduled Prop. Service

SCALE IN MILES

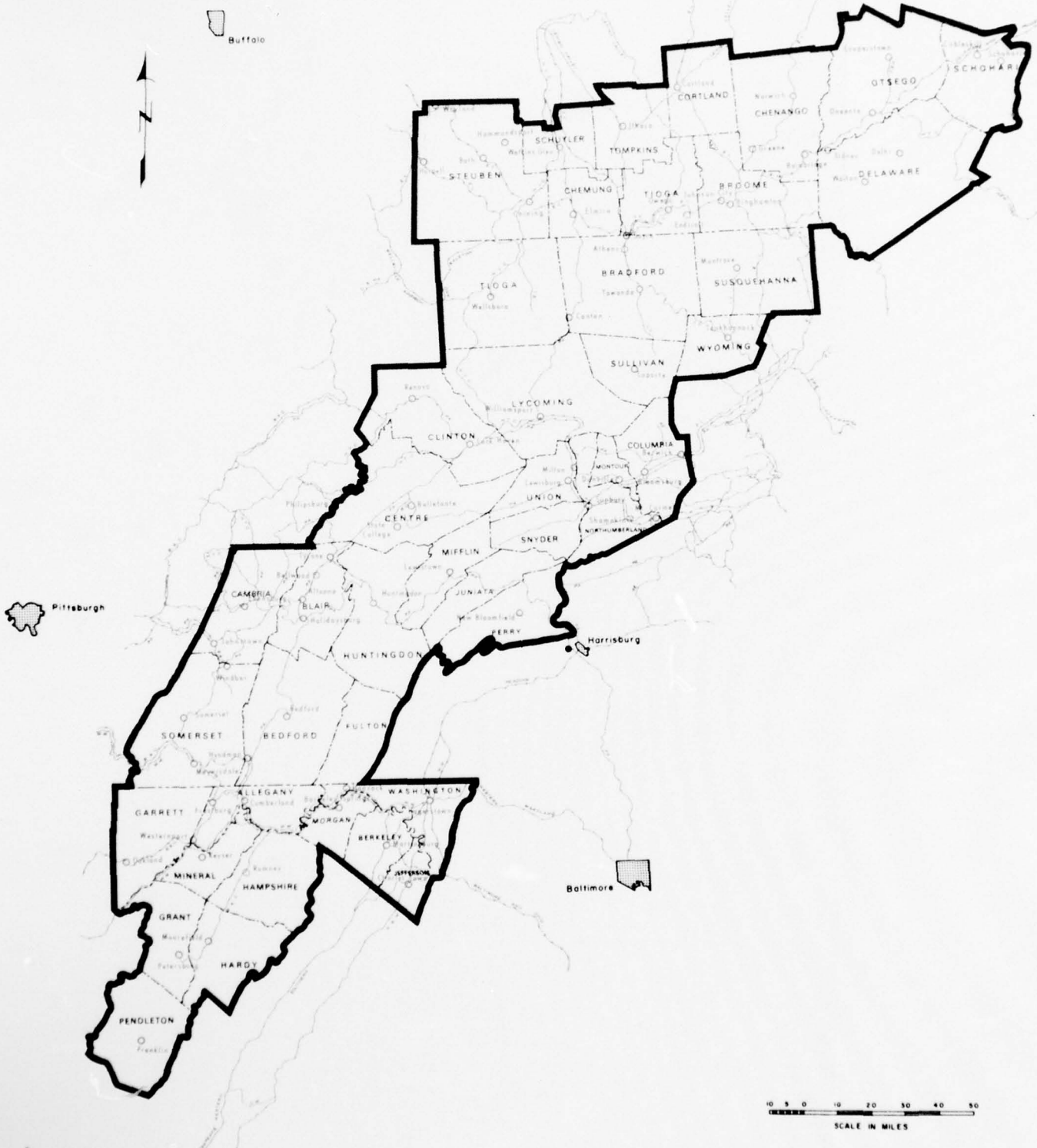
REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

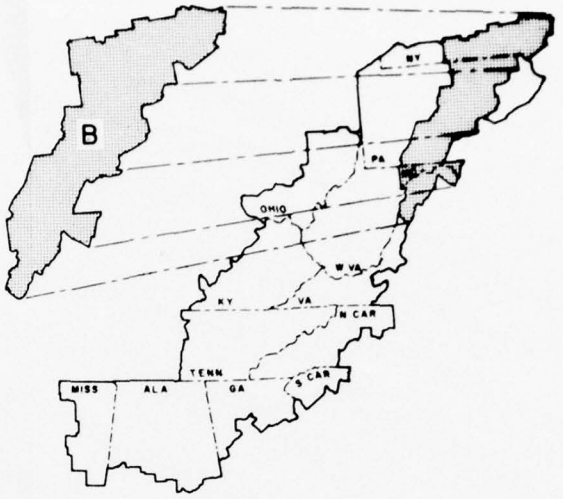
WATER SUB-REGION B

HIGHWAYS & AIRPORTS

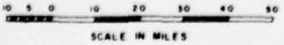
OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-3-11 **FIGURE 3-4**


Buffalo
Pittsburgh
Harrisburg
Baltimore
CORTLAND
CHENANGO
OTSEGO
SCHOHARIE
SCHUYLER
TOMPKINS
STEUBEN
CHEMUNG
TIOGA
BROOME
DELAWARE
BRADFORD
SUSQUEHANNA
WYOMING
SULLIVAN
LYCOMING
CLINTON
COLUMBIA
UNION
CENTRE
SNYDER
MIFFLIN
JUNIATA
CAMBRIA
BLAIR
PERRY
HUNTINGDON
SOMERSET
BEDFORD
FULTON
ALLEGANY
WASHINGTON
GARRETT
MORGAN
BERKELEY
JEFFERSON
MINERAL
HAMPSHIRE
GRANT
HARDY
PENDLETON
10 5 0 10 20 30 40 50
SCALE IN MILES



VICINITY MAP



REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION B

RAILROADS

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-3-13 **FIGURE 3-5**

2

State Portion	Percentage of Sub-region B Population	Persons Per Square Mile
New York	33	87
Pennsylvania	53	80
Maryland	9	127
West Virginia	5	35

Population densities, however, vary widely with major concentrations near Binghamton and Elmira, New York, Johnstown, Altoona and Sunbury, Pennsylvania, and Hagerstown, Maryland. The average density for the counties containing these communities is 200 to 300 persons per square mile. The lowest population density occurs in Pendleton, Hardy, Grant, and Hampshire Counties, West Virginia where, on the average, only 12 to 18 people live per square mile.

As shown in Figure 3-6 below, the sub-region lags far behind the United States in urbanization. While the proportion of farmers is only slightly greater than the United States proportion, the rural non-farm population is still greatly dispersed in low density areas. There is, however, considerable variation. For example, Chemung and Broome Counties, New York are nearly 75 percent urban; while there are 10 counties in Pennsylvania, Maryland, and West Virginia with virtually no urban areas (population over 2,500). Rural non-farm population ranges from 22.3 percent in Chemung County, New York, to 91.0 percent in Mineral County, West Virginia. Cambria County, Pennsylvania has the lowest proportion of farm dwellers with 2.2 percent; the high of 53.2 percent occurs in Pendleton County, West Virginia.

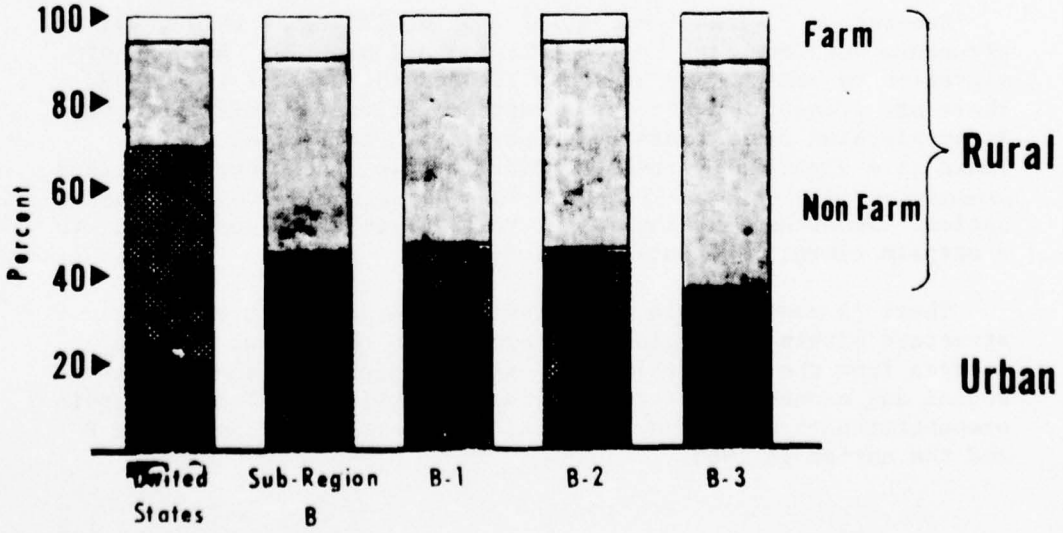


Figure 3-6 - Urban - Rural Population Distribution in the United States, Water Sub-region B and Water Areas B-1, B-2, and B-3, 1960.

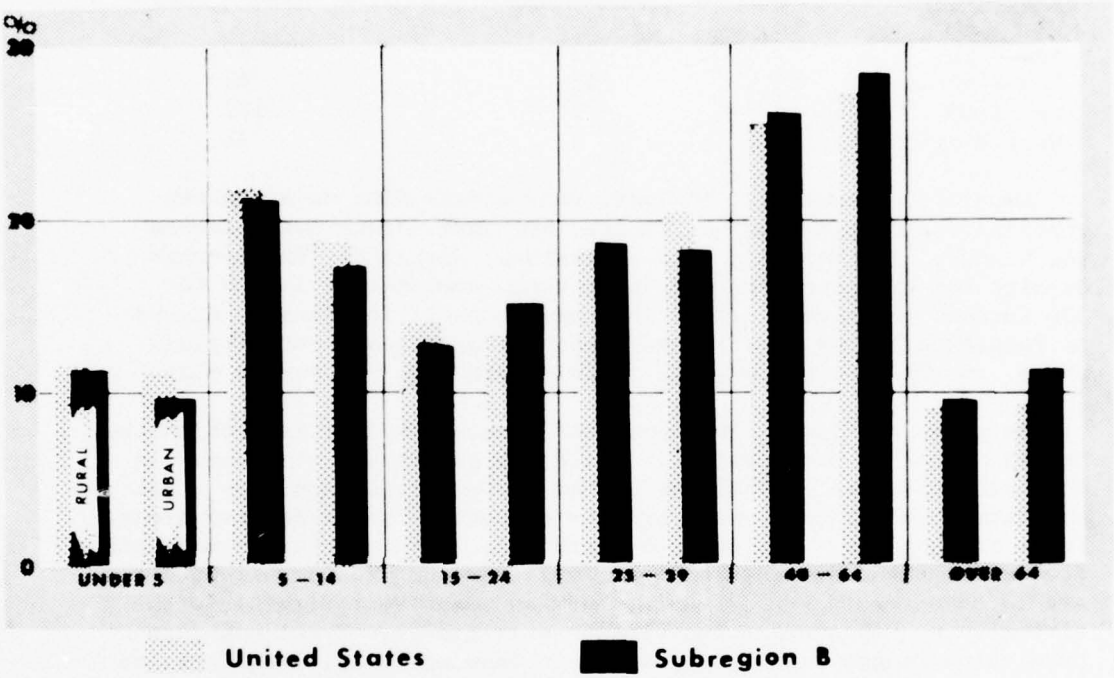


Figure 3-7 - Rural and Urban Population Distribution, by Age, United States and Water Sub-region B, 1960.

Sub-region B, like the rest of Appalachia, has a unique age structure when compared to the national age profile. Because of migration to urban areas of those between the ages of 15 and 39, there are proportionately fewer representatives of this age group in Appalachian rural areas as compared with the United States. There is a higher proportion of older people, and others with less productive ability, especially in rural Appalachia, than in the nation. Nevertheless, the higher rural birth rates counteract, to a certain extent, the out-migration.

There is considerable intra-regional variation in the age structure within Sub-region B. However, no consistent pattern emerges from the data, which varies with respect to the unique social and economic pattern of each area. Figure 3-7 is a graphic presentation of the urban and rural age profiles of Sub-region B and the nation in 1960.

For Sub-region B and each of its subdivisions, as well as for the nation, the proportion of females is slightly over 50 percent in the cities and slightly under 50 percent in the rural areas. This is due, in part, to a slightly greater migration rate of women into urban areas to seek jobs and husbands. Also, urban areas have a larger proportion of elderly people, a group that is dominated by females.

The data on educational attainment for Sub-region B indicates some dramatic contrasts when compared with the United States as shown in Figure 3-8.

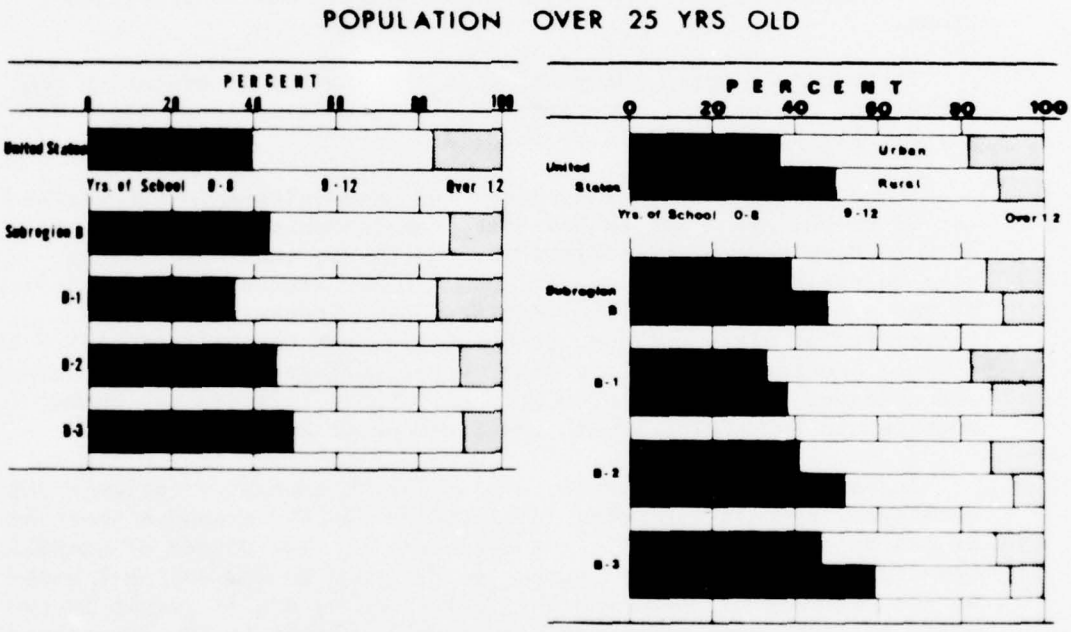


Figure 3-8 - Population Distribution by United States, Water Sub-region B and Water Areas in 1960, by Educational Attainment.

In Sub-region B, 38.2 percent of the urban population has attended zero to eight years of school, while 47.5 percent of the rural population has attended only grammar school. This compares similarly to the respective United States figures of 36.0 percent urban and 49.1 percent rural.

Of those who have attended one to four years of high school, there are 47.2 percent of the Sub-region B's urban population and 45.5 percent of the nation's urban population. The respective rural figures are 37.0 in Sub-region B, compared with 33.8 percent in the nation.

In one-to-four years of college, Sub-region B is well below the national average for both the urban and rural populations. The national figures are 11.3 percent rural, and 18.5 percent urban; for Sub-region B, they are 10.0 percent rural, and 14.6 percent urban.

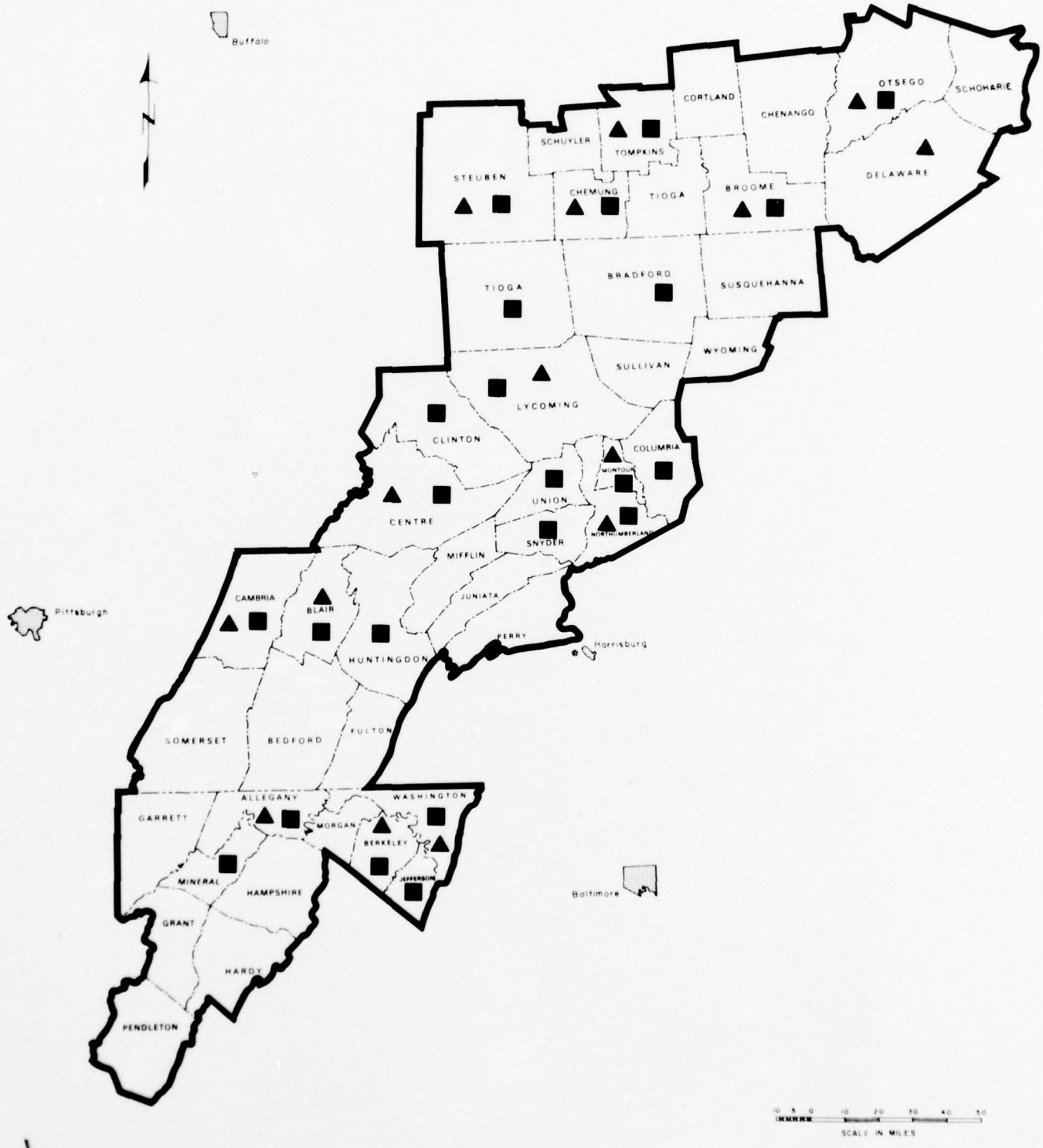
It should be noted, however, that the quality of education and content of educational programs may not be meeting local needs for further training in skills or vocation.

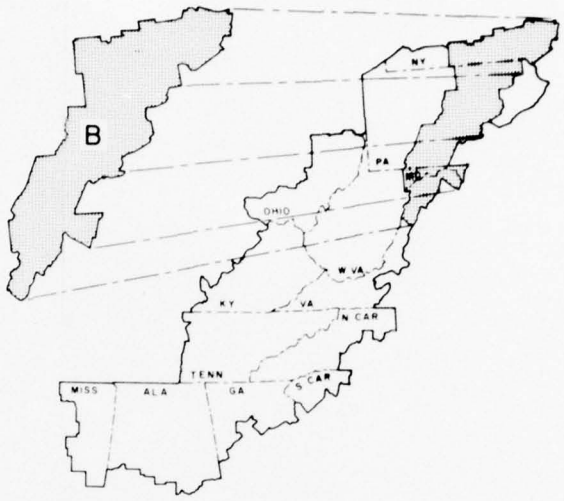
There are 20 four-year colleges and universities in Sub-region B. Of these, eight are in New York, ten in Pennsylvania, and one each in Maryland and West Virginia. Together, they have a full time undergraduate enrollment of over 70,000 students. The majority of these students are in two institutions: Pennsylvania State University at State College, Pennsylvania, and Cornell University at Ithaca, New York. There are four junior colleges, one branch campus, and numerous technical and vocational schools. Figure 3-9 shows counties in Sub-region B with institutions of higher learning.

In Maryland, Pennsylvania, and New York, community colleges and vocational schools are being initiated or rapidly expanded wherever it can be shown that sufficient needs exist. The Office of Economic Opportunity is operating a number of programs in Sub-region B aimed at the training of youth and the retraining of adults caught in the shift of industrial structure. A valuable effect is the creation of a skilled labor pool that should attract new industries into the area. However, a trained man is not likely to remain long where there is no market for his skill.

Minerals

There is a wide range of mineral resources in Sub-region B that can provide raw material for diverse mineral based manufacturing plants. In 1965, the sub-region was the source of production for 5 percent of the bituminous coal in the Appalachian Region, 31 percent of the sand and gravel, 17 percent of the stone, 9 percent of the clay, 65 percent of the salt, 42 percent of the lime, and 10 percent of the cement.


Buffalo
OTSEGO
SCHOHARIE
CORTLAND
CHENANGO
SCHUYLER
TOMPKINS
STEUBEN
CHEMUNG
TIOGA
BROOME
DELAWARE
TIOGA
BRADFORD
SUSQUEHANNA
WYOMING
SULLIVAN
LYCOMING
CLINTON
COLUMBIA
MONTOUR
UNION
CENTRE
SNYDER
NORTHUMBERLAND
MIFFLIN
JUNIATA
Pittsburgh
CAMBRIA
BLAIR
PERRY
Harrisburg
HUNTINGDON
SOMERSET
BEDFORD
FULTON
ALLEGANY
WASHINGTON
GARRETT
MORGAN
BERKELEY
MINERAL
HAMPSHIRE
JEFFERSON
Baltimore
GRANT
HARDY
PENDLETON
10 5 0 10 20 30 40 50
SCALE IN MILES



VICINITY MAP

LEGEND

■ COUNTIES WITH ONE OR MORE JUNIOR OR SENIOR COLLEGES.

▲ COUNTIES WITH ONE OR MORE TECHNICAL OR VOCATIONAL SCHOOLS.

NOTE: SCHOOLS OF NURSING AND MEDICAL TECHNOLOGY ARE LISTED UNDER BOTH OF THE ABOVE CLASSIFICATIONS.

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION B

HIGHER EDUCATION FACILITIES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-3-19 **FIGURE 3-9**

0 10 20 30 40 50
SCALE IN MILES

Bituminous coal is the largest value producer in the sub-region, and its production is on the rise after almost two decades of severe decline. Demand for thermal electric power, in the eastern Megalopolis is rejuvenating this industry. Although unit prices have declined somewhat over this period, and new regulations on strip mining are being imposed, the outlook for continued production increases is good. Virtually all of the bituminous coal production takes place in the unglaciated portion of the Appalachian Plateau, and 86 percent of 1965 production was extracted in Cambria County, Pennsylvania. Coal produces 55 percent of the value of mineral output.

Anthracite coal output is declining and is expected to dwindle even further in the future. This has placed a heavy unemployment burden on Northumberland and Columbia Counties, Pennsylvania, whose economies were formerly heavily dependent on their coal mines.

Although sand and gravel production, accounting for 8 percent of the mineral value, is scattered throughout the sub-region, the areas producing the quality of sand needed for the glass and other industries are in Morgan County, West Virginia, and Huntingdon, Lycoming, and Mifflin Counties, Pennsylvania. Other counties producing sand and gravel for construction uses include Broome and Steuben Counties, New York, and Wyoming County, Pennsylvania. These seven counties accounted for two-thirds of the sand and gravel output in the sub-region.

Lime has a significance beyond its modest share of 6.5 percent of the total mineral value output, since it is an important input into regional industries. Ninety-nine percent of the sub-region's output is extracted in Centre County, Pennsylvania, and Jefferson, Berkeley, and Pendleton Counties, West Virginia. Limestone reserves are adequate and the outlook for the industry is good.

The remaining products, cement, clays, and salt have the greatest significance due to their importance to industry and construction. The outlook for all extractive industries is optimistic with the exception of anthracite coal, and petroleum and natural gas. The former is facing a declining demand, and the latter is rapidly running out of reserves. Reserves of all other minerals are ample to meet all foreseeable demands.

Stone quarrying operations are highly dispersed throughout the sub-region producing 14 percent of mineral value. Sixty percent of the stone produced came from Blair and Centre Counties, Pennsylvania, Washington County, Maryland, and Berkeley and Jefferson Counties, West Virginia. The various types of stone produced include limestone, dolomite, dimension sandstone, and crushed sandstone.

See Figure 3-10 for a summary of mining activities in Water Sub-region B.

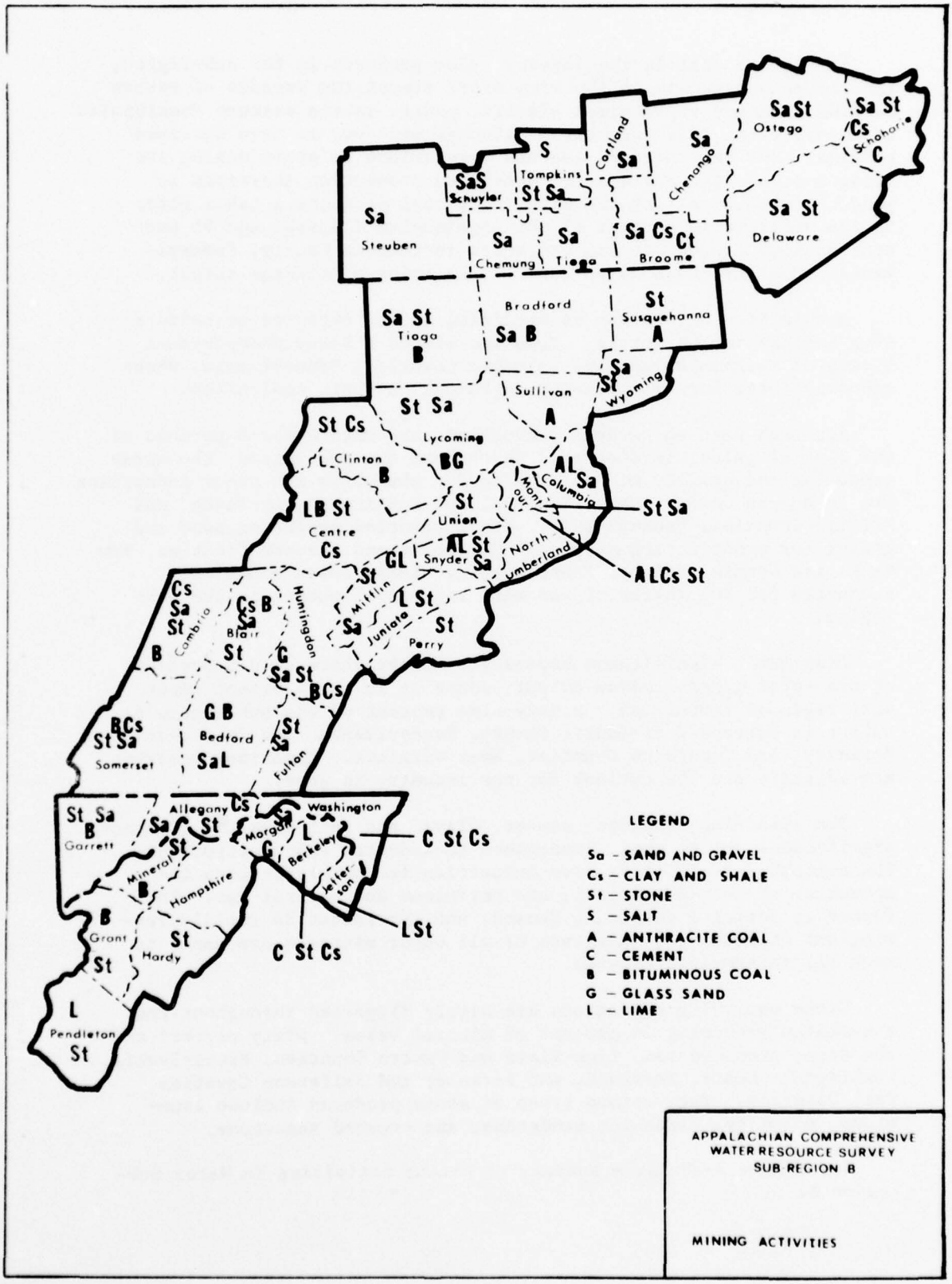

Sa St
Ostego
Sa St
Cs
Schoharie
C
S
Tompkins
Cortland
Sa
Chenango
SaS
Schuyler
St Sa
Sa
Steuben
Sa
Chemung
Sa
Tioga
Sa Cs Ct
Broome
Sa St
Delaware
Sa St
Tioga
B
Bradford
Sa B
St
Susquehanna
A
Sa
St
Wyoming
Sullivan
A
St Sa
St Cs
Lycoming
L Clinton
B
BG
AL Sa
Columbia
Mont our
St Sa
LB St
Centre
Cs
St
Union
AL St
Snyder
Sa
North umberland
GL
St
Mifflin
L St
Sa
Juniata
St
Perry
ALCs St
Cs
Sa
St
Cambria
Cs B
Sa
Blair
B
St
C
Sa St
BCs
Huntingdon
G B
Bedford
St
Sa
RCs
St Sa
Somerset
SaL
Fulton
St Sa
B
Garrett
Allegany
Cs
Washington
Sa
St
Morgan
L
C St Cs
Berkeley
C
Mineral
B
Hampshire
Jeffer son
LSt
B
Grant
St
Hardy
C St Cs
St
L
Pendleton
St
LEGEND
Sa - SAND AND GRAVEL
Cs - CLAY AND SHALE
St - STONE
S - SALT
A - ANTHRACITE COAL
C - CEMENT
B - BITUMINOUS COAL
G - GLASS SAND
L - LIME
APPALACHIAN COMPREHENSIVE WATER RESOURCE SURVEY
SUB REGION B
MINING ACTIVITIES

FIGURE 3-10

Lands

Sub-region B covers about 15 percent of the Appalachian Region and 0.8 percent of the contiguous United States. The distribution of this area by land use categories is shown in the following tabulation.

DISTRIBUTION OF LAND TYPES - SUB-REGION B (1958)

	Percent	Sq. Mi.
Land		
Agricultural		
Cropland	22	6,184
Pasture	11	3,204
Forest and Woodland	56	16,078
Other	7	1,902
Sub-Total	96	27,368
Non-Agricultural	3	905
Total Land	99	28,273
Water		
Major*	1	155
Other		118
Total Water	1	273
TOTAL AREA	100.0	28,546

*Water areas greater than 40 acres and streams greater than 1/8 mile wide.

The percent of total area devoted to farm use varies from a minimum of 11 percent in Clinton County, Pennsylvania, to 76 percent in Jefferson County, West Virginia, and averages 56 percent in New York, 40 percent in Pennsylvania, 44 percent in Maryland, and 55 percent in West Virginia.

State and Federal forests account for 3,166 square miles, 11 percent of the sub-region's land area. Of 286 square miles of Federally owned land, all but 20 square miles is in West Virginia. It is mostly in the George Washington and Monongahela National Forests. The 2,776 square miles of state forest land are divided: 335 square miles in New York, 2,164 square miles in Pennsylvania, 183 square miles in Maryland, and 94 square miles in West Virginia. In addition to these public lands, there are hundreds of square miles of local, county, and state recreation areas, and state and Federal lands in other uses such as administrative buildings, roadways, military posts, airports, and National Parks.

In 1949, about 59 percent of Sub-region B, or 10.8 million acres, was in farms. This fell to 8.5 million acres, or 46 percent of Sub-region B in 1964. There was a 44 percent reduction in the number of farms during this same period, from 78,628 to 42,807. Average size of farms increased from 137 to 193 acres.

These changes are the result of higher yields and more efficient farm production due to improved technology. Many marginal farm operators have abandoned farming to seek other employment. Part of their land has been annexed by the more efficient operators, and the remaining land has shifted to various non-farm uses.

Many farm owners are elderly and in semi-retirement, or are part-time farmers who are employed elsewhere. Land is often rented to farmers wishing to expand their operations.

The natural, inherent handicaps of mountainous terrain keep the region's agriculture at a comparative disadvantage with that of the nation's better farm marketing areas.

Urban and highway expansion also contribute to the shifting of land out of agriculture.

Only about 36 percent of the sub-region is suited for intensive long-term cultivation. The remaining non-urbanized lands are best kept in a permanent vegetative cover such as grass, trees, and shrubs. Only about two percent of the sub-region's soils have few or no problems. Erosion by water or wind is a dominant problem on about 56 percent of the sub-region's soils. Excess water caused by high water table or frequent temporary flooding is the main problem on an additional 16 percent. Unfavorable soil conditions, such as extreme shallowness, stoniness, or droughtiness, affect another 26 percent.

In 1962, approximately 60 percent of Sub-Region B was in forest or woodland. The present forest soil cover serves reasonably well to hold the soil in place. However, past management, land clearing, livestock grazing, timber cutting and forest fires have caused the destruction of much of the surface mulch and surface soil organic matter. The result is that about one third of the forest land is in poor hydrologic condition with limited capacity to retard runoff and store moisture. About 95 percent of the forest land has a high medium potential to improve hydrologically, if given proper management and protection.

Approximately 98 percent of the forest land in Sub-region B is capable of producing commercial timber. There are an estimated 11 million cubic feet of growing stock of which about 90 percent is in hardwoods. An increase in forest acreage of about 565,000 acres is expected to occur between 1958 and 1975, coming mostly from abandoned crop or pasture land.

Environmental Aspects

Topographic variations, including long ridges and valleys broken by wind and water gaps and rolling plateaus, combine with numerous streams and rivers and a varied flora to provide a scenic area. Picturesque valley farms and small towns visible from highways are typical in the sub-region. However, major portions of the mountainous lands are wild in character with few roads and a sparse population. A few of the outstanding scenic attractions include Spruce Knob and Seneca Rocks in West Virginia; the Chesapeake and Ohio Canal, Maryland; Pine Creek Gorge, also known as Grand Canyon of Pennsylvania, and Bucktail Trail in Pennsylvania; Watkins Glen and Taughannock Falls in New York (see Figure 3-11).

Identified potential additions to the national wild and scenic river system established by Congress in 1968 are Pine Creek from Ansonia to Waterville, Pennsylvania; and the Youghiogheny River from Oakland, Maryland to the sub-region boundary.

Legislation is pending in Congress which would develop the Potomac River from Washington, D.C. to Cumberland, Maryland. Provision would be made for land acquisition for public use, scenic easements, zoning, recreation development, and other measures to protect and enhance the scenic values of this river.

The sub-region's natural beauty is further enhanced by the regeneration of ground cover and trees on lands previously logged or cleared for agriculture. Land and water conservation practices underway on private and public lands also add to the beauty of the area.

As a resource, the scenic beauty is important to the resident as well as to the sightseer coming from the metropolitan centers in and adjacent to Sub-region B. Seasonal interest in the scenic beauty, especially during the fall, is evidenced by foliage festivals, auto tourism, and specially scheduled trains and buses. Future development of Appalachian Corridors and other highways will open new areas of scenic beauty to the sightseers. Construction of the proposed Allegheny Parkway and the Potomac Heritage Trail with emphasis on enhancement of this scenic corridor, could attract millions of sightseers. In an area which has few natural lakes, water resource developments such as Tioga-Hammond, Blanchard, and Raystown Reservoirs, as well as other water projects, will add greatly to the visual variety of the landscape. A broad master plan for development of recreational and aesthetic values in north-central Pennsylvania has been developed.

The scars left by open pit mining operations and the related spoiling of streams by acid mine drainage mar the natural beauty of parts of this scenic region. In Sub-region B, this problem occurs in both the anthracite coal area in Northumberland, and Columbia Counties, and in the bituminous coal areas to the west in Somerset

and Cambria Counties. Other Pennsylvania, Maryland, and West Virginia counties also have some mining scars, but they are more widely scattered. Attempts to alleviate this problem and research to develop additional solutions are underway. In addition, regulations governing the operation of active mining in the area will help to prevent additional damage.

Cold, rushing, high-country streams provide good trout fishing, while the warmer, slower-moving rivers offer fishing for bass, catfish, suckers, bullheads, and non-game species. These stream fisheries are enhanced by the hundreds of natural and man-made ponds, and a few natural lakes and reservoirs. Presently there are 1,355 farm ponds being stocked and managed for fish production. Active stocking programs, including warm and cold water fish, are prevalent throughout the area.

Stream resources are presently limited by flow fluctuations, poor habitat, and industrial, agricultural, and domestic pollution. The mine drainage problem which occurs in parts of Sub-region B has seriously limited the value of some fisheries and causes periodic fish kills.

Future demands will require intensive management and additional utilization of fishery resources. Water quality standards will help to improve the fishery. Impoundments, properly located, can substantially increase fishing opportunities, and improved access with support facilities will open new areas for the fisherman.

The varying habitat of this area supports an abundant wildlife population. White tail deer are found throughout the area and provide major hunter interest. Deer population has reached a peak in some wooded portions of the area where the food supply is decreasing because of maturing forests. Black bears are found in the mountainous areas and wild turkey populations are on the increase. Small game include grouse, pheasant, quail, rabbits, and squirrels. The major riverways provide a rather marginal waterfowl habitat.

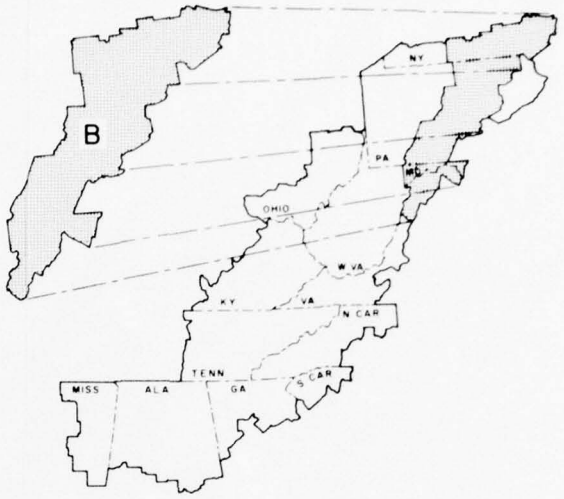
Wildlife production is presently limited by loss of habitat due primarily to urban, industrial, and highway development in lowland areas. With the decline in agricultural activities, farm game species such as rabbits and pheasants may decrease. The loss will be offset somewhat by a corresponding increase in forest game species such as grouse and wild turkeys.

Future demands will be met through conservation programs and changes in land use. Present land use changes include conversion of 113,900 acres of land to wildlife and recreation uses, and 342,600 acres to wildlife habitat.

Buffalo
Pittsburgh
Harrisburg
Baltimore
N
ROBERT H. TREMAN ST. PK.
STONY BROOK ST. PK.
TAUGHANNOCK FALLS ST. PK.
BUTTERMILK FALLS ST. PK.
ROBERT H. TREMAN STATE PARK
WILLIAMS GLEN ST. PK.
NEWTON BATTLEFIELD RESERVATION
GLUMMERGLASS ST. PK.
HUNTS POND ST. PK.
GILBERT LAKE ST. PK.
BOWMAN LAKE ST. PK.
CHENANGO VALLEY ST. PK.
HILLS CRK. ST. PK.
COLTON PT. ST. PK.
GRAND CANYON OF PENNSYLVANIA ST. PK.
LEONARD HARRISON ST. PK.
WORLDS END ST. PK.
HYNER RUN ST. PK.
LITTLE PINE ST. PK.
KETTLE CRK. ST. PK.
SUSQUEHANNA ST. PK.
RAVENSBURG ST. PK.
RAYMOND D. WINTER ST. PK.
JOSEPH PRIESTLY HOUSE
SHIKELLAMY ST. PK.
BALD EAGLE
CANOE CREEK
BLACK MOSHANNON ST. PK.
POE VALLEY ST. PK.
28th DIVISION SHRINE
WHIPPLE DAM ST. PK.
SNYDER-MIDDLESWORTH ST. PK.
MIDDLE CREEK
PRINCE GALLITZIN ST. PK.
GREENWOOD FURNACE ST. PK.
REEDS GAP ST. PK.
TUSCARORA ACADEMY
LITTLE BUFFALO
ADMIRAL PEARY PARKS
TROUGH CREEK ST. PK.
BIG SPRING ST. PK.
BLUE KNOB ST. PK.
WARRIORS PATH ST. PK.
ROOSER ST. PK.
LAUREL HILL ST. PK.
SHAWNEE ST. PK.
CONAWAY GAP ST. PK.
LAUREL RIDGE
FT. TONOLWAY ST. PK.
CASSELMAN BRDG. ST. PK.
NEW GERMANY ST. PK.
DEEP CRK. LK. ST. PK.
SWALLOW FALLS ST. PK.
HEBBINGTON MANOR ST. PK.
DAINS HT. ST. PK.
BIG RUN ST. PK.
FT. FREDERICK ST. PK.
ANTIETAM NAT. BATTLEFIELD SITE
GREENBRIER ST. PK.
WASHINGTON MON. ST. PK.
GATHLAND ST. PK.
CACAPON STATE PK.
HARPERS FY NAT. HIST. PK.
LOST RIVER ST. PK.
SCALE IN MILES

IDDLE CREEK

ALO



VICINITY MAP

LEGEND

- STATE PARKS
- NATIONAL HISTORIC AREAS, SITES AND PARKS
- SPRUCE KNOB-SENECA ROCKS NATIONAL RECREATION AREA

10 5 0 10 20 30 40 50
SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION B

SCENIC & HISTORICAL SITES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-3-27 FIGURE 3-11

To meet Appalachian objectives, the values of preserving and enhancing natural conditions must be considered against the need for particular structural measures needed to meet economic and social requirements.

Appendix G to the Main Report contains detail on the fishing and hunting resources in Appalachia, and Appendix F discusses aesthetics and recreation.

Water Resource Development - Federal

Corps of Engineers

Reservoir Projects. The Almond Reservoir is located in western Steuben County, New York on Canacadea Creek in the headwaters of the Canisteo River, a branch of the Susquehanna River. The project controls a drainage area of 56 square miles and provides 14,800 acre-feet of storage, of which 14,270 is for flood control. It forms a part of the protection provided for Hornell, Canisteo and Addison and reduces flood heights in downstream reaches. The permanent pool and surrounding lands serve recreation.

Arkport Reservoir, a short distance from Almond Reservoir, is on the Canisteo River and provides 7,950 acre-feet of flood control. It has no recreation pool. The project also forms part of the protection for Hornell, Canisteo and Addison and reduces flood heights in downstream areas.

East Sidney Reservoir on Ouleout Creek in Otsego County, New York, is also in the Susquehanna Basin. It provides 32,500 acre-feet of storage of which 31,850 is for flood control and the remainder is a permanent pool for recreation. The project forms part of the protection for Binghamton, New York, and reduces flood heights throughout the downstream reaches of the North Branch of the Susquehanna.

Whitney Point Reservoir, New York, on the Otselic River, is in Cortland and Broome Counties. The project forms part of the protection for Binghamton and reduces flood heights on the lower Tioughnioga and Chenango Rivers and on the Susquehanna River downstream of Binghamton. The reservoir contains 81,500 acre-feet of flood control space and a 5,000 acre-foot permanent pool. Development of recreational facilities to utilize the 1,200 surface acre permanent pool is underway in cooperation with the State Conservation Department and Broome County authorities.

Kettle Creek Reservoir, Pennsylvania, in northwestern Clinton County, provides flood control in the upper Susquehanna Basin above Williamsport. The reservoir has 73,410 acre-feet of flood control and 1,590 acre-feet of permanent pool storage. The project includes recreation storage.

Stillwater Reservoir, part of the comprehensive plan for flood control in the Susquehanna Basin, is located on the Lackawanna River in Susquehanna County, Pennsylvania. It reduces flood stages in the Lackawanna River and in the Susquehanna River. Carbondale and Scranton, in Sub-region A, are the principal communities receiving flood benefits. The reservoir provides 11,600 acre-feet of flood storage, 200 acre-feet for water supply, and 200 acre-feet for a permanent pool.

Pertinent data for the completed and authorized projects is given in Table 3-3, and their locations are shown on Figure 3-12.

There are four authorized reservoir projects which are in advance planning or under construction (1966) which will provide flood control, recreation and other benefits to Sub-region B.

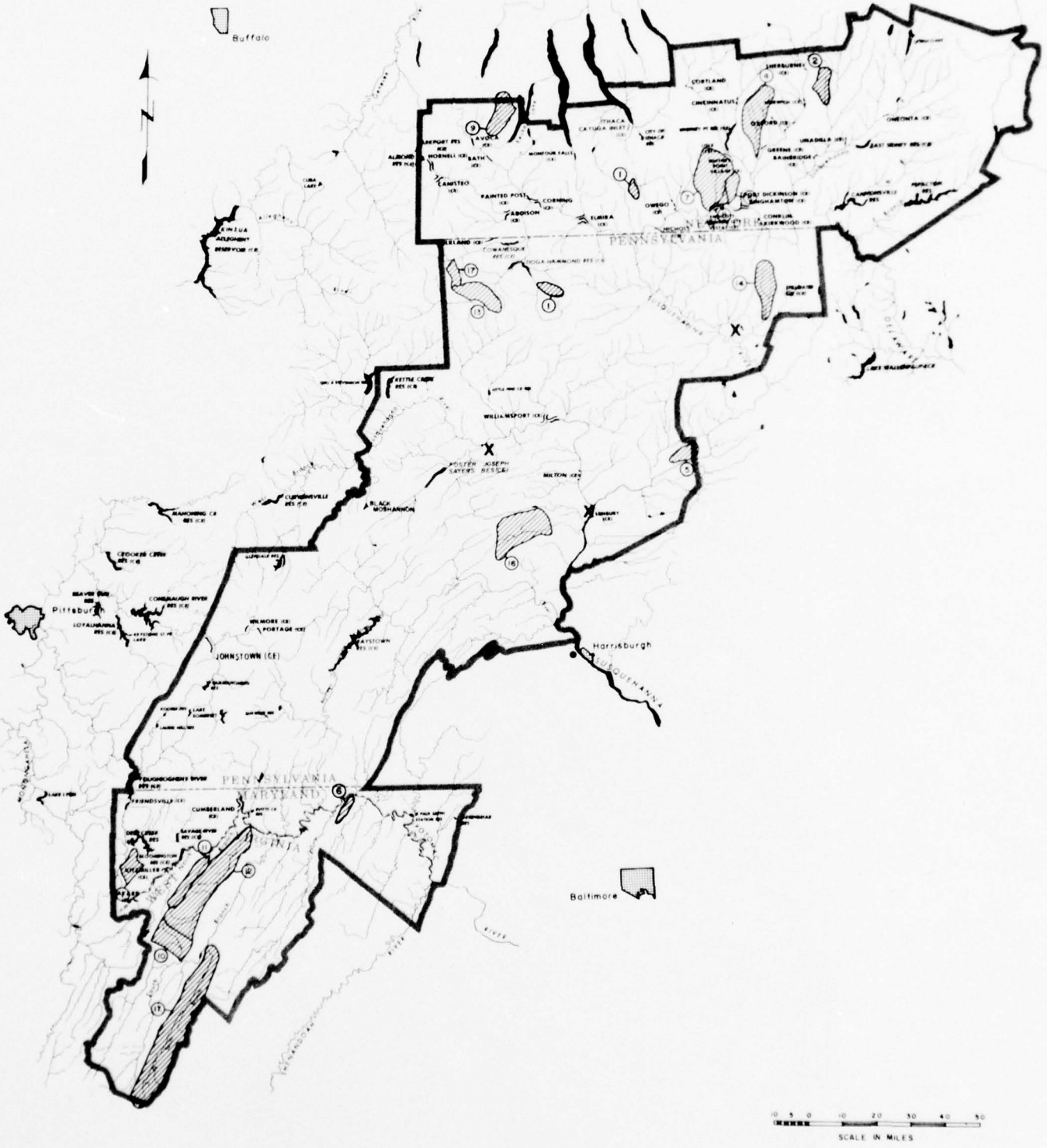
The Tioga-Hammond Reservoir project, located in Tioga County, Pennsylvania, consists of two separate dams; one on the Tioga River and one on Crooked Creek. They will be joined by a diversion channel. The storage capacity of the project will be 130,000 acre-feet. The reservoir will reduce flood heights on the Chemung River at Corning and Elmira, New York, and on the Susquehanna River below Athens, Pennsylvania.

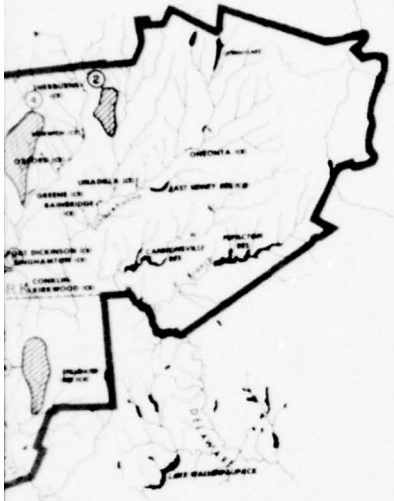
The Cowanesque Dam, also in Tioga County, Pennsylvania, will be located on the Cowanesque River. It has a flood control storage of 95,700 acre-feet, and will assist the Tioga-Hammond Reservoir in controlling floods on the Chemung River.

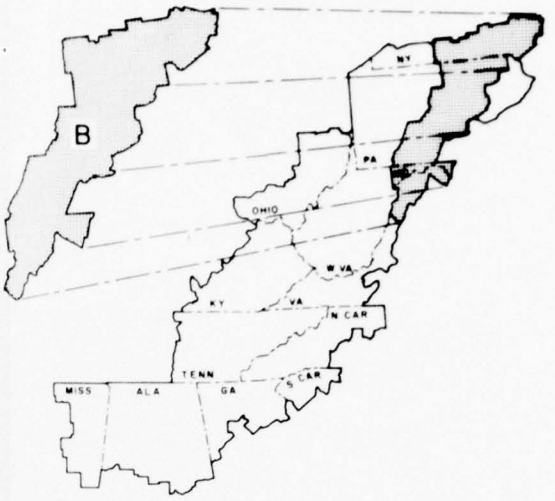
Foster Joseph Sayers Dam and Reservoir (Blanchard Reservoir) is on Bald Eagle Creek in Centre County. The construction of the reservoir was recently completed. It is operational for flood control, reducing flood stages on Bald Eagle Creek and along the West Branch Susquehanna River below Lock Haven. In future years recreation facilities will be constructed around a 1,730 acre permanent pool.

Raystown Reservoir in Huntington County, Pennsylvania, is under construction on Raystown Branch, Juniata River, 5-1/2 miles upstream of its confluence with the Juniata River. The reservoir will provide flood control, water quality control and recreation. Benefits will extend into the Susquehanna River. The flood control storage is 248,000 acre-feet equal to about 5 inches of runoff from the 690 square mile drainage area. Extensive facilities for recreation, fishing and hunting are to be provided.

Bloomington Reservoir, located in Garrett County, Maryland, and Mineral County, West Virginia, is on the North Branch of the Potomac River. It will provide low flow augmentation, flood control and recreation. Of the 130,900 acre-feet of storage, 36,200 are for


Buffalo
PENNSYLVANIA
Pittsburgh
JOHNSTOWN (CE)
Harrisburgh
PENNSYLVANIA
MARYLAND
Baltimore
10 5 0 10 20 30 40 50
SCALE IN MILES





VICINITY MAP

	COMPLETED	EXPECTED TO BE COMPLETED BY 1980
UPSTREAM WATERSHEDS	6	5
MAJOR RESERVOIRS		
CHANNEL IMPROVEMENTS		
LEVEE OR WALL		

STATE RECREATION AND/ OR FISHING LAKE:
SURFACE AREA IN EXCESS OF 200 ACRES X

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION B

WATER RESOURCES DEVELOPMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-3-31 **FIGURE 3-12**

10 5 0 10 20 30 40 50
SCALE IN MILES

2

TABLE 3-3
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION B

	Corps of Engineers Completed Projects					
ITEM	Almond Res.	Arkport Res.	East Sidney Res.	Kettle Creek Res. Alvin R. Bush	Whitney Point Res.	Stillwater Res.
LOCATION:						
Stream	Canacadea Cr.	Canisteo R.	Ouleout Cr.	Kettle Cr.	Otselic R.	Lackawanna
Basin	Susquehanna	Susquehanna	Susquehanna	Susquehanna	Susquehanna	Susquehanna
County	Steuben	Steuben	Delaware	Clinton	Broome	Susquehanna
State	N.Y.	N.Y.	N.Y.	Pa.	N.Y.	Pa.
STATUS:	Operating	Operating	Operating	Operating	Operating	Operating
Authorized Purposes	FC,R	FC	FC,R	FC,R	FC,R	FC,WS
Completion Date	1949	1939	1950	1962	1942	1960
Drainage Area (sq.miles)	56.	31.	102.	226.	255.	37.
ELEVATION:						
Top of Upper Pool FC/NA	1,300	1,304	1,203	937	1,010	1,621
Top of Conservation Pool	1,255		1,150	840	973	1,572
STORAGE CAPACITY:	Acre feet					
Flood Control	14,270	7,900 1/	31,850	73,410	81,474	11,600
Power	--	--	--	--	--	--
Water Quality	--	--	--	--	--	--
Water Supply	--	--	--	--	--	200
Sediment and Silt Reserve	64	50	50	--	26	200
Recreation	466	--	1,650	1,590	5,000	
TOTAL	14,800	7,950	33,550	75,000	86,500	12,000
Joint Use (Summer Pool)	510	--	1,650	--	6,500	--
SURFACE AREA:	Acres					
Top of Upper Pool FC/Power	490	192	1,100	1,430	3,340	422
Top of Conservation Pool	124	--	210	160	1,200	83
POWER INSTALLATION:						
Capacity (1,000 kw)	--	--	--	--	--	--
No. of units	--	--	--	--	--	--
Yield for water supply MGD	--	--	--	--	--	--
Water Quality Release cfs	--	--	--	--	--	--
Low Flow Augmentation cfs	--	--	--	--	--	--

Appropriate Footnotes.

1/ ungated outlet

TABLE 3-3 (cont'd)
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION B

Corps of Engineers

ITEM	Completed Projects (cont'd)		Projects in Advanced Planning and Design				
	Savage Res.	Youghiogheny Res.	Raystown Res.	Cowanesque Res.	Tioga-Hammond Res.	Foster Joseph Sayers Dam & Res.	Bloomington Res.
LOCATION:			Raystown Br.		Crooked Cr.	North Bald	
Stream	Savage R.	Youghiogheny R.	Juniata R.	Cowanesque R.	Tioga R.	Eagle Cr.	North Br.
Basin	Potomac	Ohio	Susquehanna	Susquehanna	Susquehanna	Susquehanna	Potomac
County	Garrett	Somerset	Huntington	Tioga	Tioga	Centre	Garrett-Mineral
State	Md.	Pa.	Pa.	Pa.	Pa.	Pa.	Md.--W. Va.
STATUS:	Operating 2/	Operating	Auth. AP	Auth. AP	Auth. AP	Auth. AP	Auth. AP
Authorized Purposes	Flow Aug.FC		FC,R Flow Aug.		FC,R	FC,R	WS,FC,R Flow Aug.
Completion Date			--	--	--	--	--
Drainage Area (sq.miles)	105.	434.	960.	299.	402.	339.	263.
ELEVATION:							
Top of Upper Pool FC/NA	1,468.5		812	1,117	1,131	657	1,500
Top of Conservation Pool			786	1,009	1,085	630	1,466
STORAGE CAPACITY:	Acre feet						
Flood Control	--	151,000	247,000	95,700	105,000	92,700	78,200
Power	--	--	--	--	--	--	--
Water Quality	20,000	--	--	--	--	--	--
Water Supply	--	5,200	--	--	--	--	--
Sediment and Silt Reserve	--	--	39,000	--	--	20	2,700
Recreation			514,000	--	20,000	6,280	50,000
TOTAL	20,000	254,000	762,000	95,700	125,000	99,000	130,900
Joint Use (Summer Pool)	20,000	97,800	38,000	900	5,000	19,200	8,000
SURFACE AREA:	Acres						
Top of Upper Pool FC/Power	360	3,570	10,800	2,170	3,400	3,450	1,184
Top of Conservation Pool	--	2,840	8,300	160	1,210	1,730	952
POWER INSTALLATION:							
Capacity (1000 kw)	--	--	--	--	--	--	--
No. of Units	--	--	--	--	--	--	--
Yield for water supply MGD	--	--	--	--	--	--	--
Water Quality Release cfs	--	--	--	--	--	--	--
Low Flow Augmentation cfs	93	--	480		--	--	212

Appropriate Footnote. 2/ Maintained & Operated by State of Md.

FC Flood Control
R Recreation
WS Water Supply
Flow Aug. Flow Augmentation

flood control and 92,000 for augmenting low river flows. The reservoir will provide a dependable flow of 305 cfs at Luke, Maryland, and prevent 42 percent of the average annual flood damages along the North Branch. The surrounding reservoir lands, including boat launching ramps and camping areas, will provide recreation.

Local Protection Projects. The Corps of Engineers has completed the following local flood protection projects in Sub-region B.

TABLE 3-4
LOCAL PROTECTION PROJECTS, WATER SUB-REGION B

Susquehanna Basin

NEW YORK

Location	County	Type of Project
Addison	Steuben	levees and walls
Avoca	Steuben	levees and channel improvement
Bainbridge	Chenango	channel improvement
Bath	Steuben	levees and walls
Binghamton	Broome	levees, walls and channels
Canisteo	Steuben	levees and channels
Cincinnatus	Cortland	snagging and clearing
Conklin-Kirkwood	Broome	channel improvement
Corning	Steuben	channel improvement
Cortland	Cortland	channel improvement
Elmira	Chemung	levees and walls
Endicott-Johnson City-Vestal	Broome	levees, walls and channel improvement
Greene	Chenango	channel improvement
Hornell	Steuben	levees, walls, channel improvement
Lisle	Broome	levees, walls, channel improvement
Nichols	Tioga	levees (under construction 1968)
Norwich	Chenango	channel improvement
Oneonta	Otsego	snagging and clearing
Owego	Tioga	snagging and clearing
Oxford	Chenango	levees and channel improvement
Painted Post	Steuben	levees, walls, channel improvement
Port Dickinson	Broome	snagging and clearing
Sherburne	Chenango	snagging and clearing
Unadilla	Otsego	concrete channel
Whitney Point Village	Broome	levees and channel improvement

TABLE 3-4 (Cont'd)
LOCAL PROTECTION PROJECTS, WATER SUB-REGION B

Susquehanna Basin (Cont'd)

PENNSYLVANIA

Location	County	Type of Project
Elkland	Tioga	levees and channel
Milton	North Umberland	snagging and clearing
Sunbury	North Umberland	levees and walls
Williamsport	Lycoming	levees, walls and channels

Ohio Basin

PENNSYLVANIA

Johnstown	Cambria	walls and channel improvement
Portage	Cambria	channel improvement
Wilmore	Cambria	channel improvement

MARYLAND

Friendsville	Garrett	channel improvement

Potomac Basin

MARYLAND

Cumberland & Ridgely, W.Va.	Allegheny	channel, levees and walls
Kitzmiller, Md. & W.Va.	Garrett	channel, wall, and levee

WEST VIRGINIA

Potomac Basin

Bayard	Grant	levees and channel improvement
Ridgley & Cumberland, Md.	Mineral	channels, levees and walls

NEW YORK

Oswego Basin

Montour Falls	Schuyler	levees and channel improvement

The Ithaca, Cayuga inlet project in Tompkins County is under construction. It will consist of channel improvement levees and a drop-structure.

U.S. Department of Agriculture

Completed Watersheds. The Soil Conservation Service of the Department of Agriculture has responsibility for Public Law 566 projects. These include land treatment and management in upstream watershed project areas, structures for detention of flood waters and storage for irrigation, water supply, water quality management, recreation and fish and wildlife.

The locations of the four upstream watershed projects completed for operation as of July 1967 are shown on Figure 3-12. Pertinent data is given as follows:

Map Ref. Number (Fig. 3-12)	State	Watershed Name	County	Project Area sq. mi.	# of Structure	Miles of Channel
1	N.Y.	Dean Creek	Tioga	9.88	-	-
2	N.Y.	Great Brook	Chenango	26.20	1	0.3
1	Pa.	Cory Creek	Tioga	24.10	-	-
6	W. Va.	Warm Springs River	Morgan	11.35	9	0.3
9	N.Y.	Upper Five Mile Creek	Steuben, Yates	59.53	-	0.1
TOTAL				131.06	10	0.7

Two of the 4 watershed projects control 3.93 square miles using 10 detention structures with 511 acre-feet of flood storage. The projects provide annual flood control benefits of $51,718 and total benefits of $51,908. The projects prevent 67 percent of average annual flood damages and provide for a small amount of more intensive land use.

Approved Watershed Projects. Additional upstream watershed projects have been authorized as of July 1967, and are described in Table 3-5. These watershed projects cover 1,360 square miles, contain 119 detention structures, of which 17 are multi-purpose projects, and 15 miles of channel improvement. The projects will control 485 square miles. They contain the following storages:

Flood control	89,322 acre-feet
Sediment	9,047
Municipal & Industrial Water Supply	1,781
Recreation	5,902
Fish and Wildlife	2,673
Irrigation	-
Total	108,725

The estimated installation costs of these 15 projects totals $3.45 million for land treatment and $25.1 million for structural measures. They will provide an estimated 253,000 annual recreation

TABLE 3-5
UPSTREAM WATERSHEDS - AUTHORIZED FOR INSTALLATION PROJECTS
STRUCTURAL MEASURES

SUB-REGION B

Map Ref. Number (Fig. 3-12)	State	Watershed Name	Project Area (Sq. Mi.)	Number Structures (No.)	Channel Improvement (Miles)	Estimated Installation Cost Land Treatment ($1,000)	Structural Measures ($1,000)	Flood Plain Area (Acres)
1	Md.	Little Youghiogheny River	41.05	6	1.6	473.0	1,465.5	1,000
4	N.Y.	Genegantslet Creek	103.84	2	5.0	144.9	167.8	1,105
6	N.Y.	L. Choconut, Finch Hollow, Trout Brook	19.18	7		152.2	1,502.7	303
7	N.Y.	Nanticoke Creek	114.06	11	5.6	222.0	2,570.8	1,100
8	N.Y.	Patterson, Briskus, Grey	12.50	1		33.3	430.3	
5	Pa.	Briar Creek	14.67	3		35.4	610.5	150
13	Pa.	Marsh Creek	82.72	5		111.9	1,370.5	750
14	Pa.	Martin Creek	49.50	2		113.4	231.6	1,500
16	Pa.	Middle Creek	131.40	3		371.8	2,703.5	547
17	Pa.	Mill Creek	13.17	3	1.2	227.5	583.3	120
10	W.Va.	Lunice Creek	89.51	5	0.61	148.4	1,935.8	1,159
11	W.Va.	New Creek - Whites Run	56.58	12		88.3	1,569.0	
12	W.Va.	Patterson Creek	283.20	35	0.85	759.6	5,038.2	7,172
17	W.Va.	South Fork	288.83	24		217.9	4,609.8	9,200
TOTAL			1,300.14	119	14.86	3,099.6	24,789.3	24,106

days and serve 17,000 people with a water supply. These projects will prevent over $1.1 million in average annual damages and provide total annual benefits of over $1.8 million. The projects are estimated to prevent 66 percent of the flood damages in the upstream watershed areas.

Land Use Programs. The land use, treatment, and management program of the various U.S. Department of Agriculture agencies are contributing significantly to the improvement of water quality of the sub-region by reduction of erosion and sediment. Basic conservation plans are being put into effect for about 3,755,000 acres by over 21,600 landowners and operators cooperating with their local soil and water conservation districts. To date, a total of 2,848,000 acres, or 16 percent of the land in the sub-region, have been adequately treated through the application and installation of conservation practices needed to meet its planned use, improvement, and protection.

The U.S. Forest Service is cooperating with State forestry agencies in the protection and management of over 8,553,000 acres (47 percent of the sub-region) of privately-owned forest and woodland. Assistance to local organizations and individuals in planning and installing forestry measures for watershed protection and flood prevention is provided by State Foresters in cooperation with the Forest Service. These cooperative programs also provide forest fire protection, insect and disease control, technical assistance to improve the management of forests and the operations of small forest products processors, and to produce and distribute forest planting stock.

The Forest Service administers about 183,000 acres of land in the Monongahela and George Washington National Forests and the Hector Land Use Area. These lands are managed under the multiple use concept for the production of high quality water, timber, fish and wildlife and recreation.

In 1966, nearly 350,000 visitor days were spent in these areas for camping, picnicking, fishing, hunting, sightseeing and driving for pleasure. Ninety acres have been developed and these can accommodate 1,920 persons at one time.

Other Water Resources Programs. The U.S. Department of Agriculture's Farmers Home Administration has received applications for water and sewer comprehensive planning grants from 23 counties totaling about $257,150. In addition, applications have been received for loans and grants for improving, enlarging, or constructing sewer systems, waste treatment plants, or storm drains from 58 communities, associations, public service districts, and towns. Total estimated costs exceed $27,354,000.

Water Resources Development - Non-Federal

A considerable number of state, municipal, and private reservoirs exist in the area. Their primary purpose is municipal and industrial water supply, recreation, fishing, and hydropower generation.

Table 3-6 is a partial list of significant projects based on a total storage greater than 1,000 acre-feet and/or a surface area of 200 acres or greater.

TABLE 3-6
NON-FEDERAL IMPOUNDMENTS - WATER SUB-REGION B

Basin	State	Name of Reservoir	County	Purpose 1/	Total Storage Acre-feet	Surface Area Acres
Ohio						
	Pa.	Quemahoning	Somerset	FH	39,000	900
	Pa.	Salt Lick	Cambria	M	2,700	67
	Pa.	North Fork Res.	Somerset	M	3,580	94
	Pa.	Indian Lake	Somerset	R	24,400	750
	Pa.	Howell's Run	Cambria	M	1,400	82
	Md.	Deep Creek	Garrett	P,R	92,988	4,500
	Pa.	Coxes Creek (Lake Somerset)	Somerset	M,R	1,000	253
	Pa.	High Point Lake	Somerset	R	5,560	342
Potomac						
	Md.	Evitts Creek	Allegany	R	9,000	240
	Md.	Greenbrier	Washington	R	1,000	42
	Pa.	Thomas K. Koon	Bedford	M	8,050	268
	Pa.	Lake Gordon	Bedford	M	4,550	120
Susquehanna						
	Pa.	Shawnee Lake	Bedford	F,R	16,750	1,070
	Pa.	Lake Altoona	Blair	M	2,600	70
	Pa.	Lower Dam	Blair	M	1,190	43
	Pa.	Mill Run	Blair	M	2,860	77
	Pa.	Wilmore	Cambria	M	3,330	90
	Pa.	Glendale	Cambria	R	41,200	2,150
	Pa.	Black Moshennon	Centre	R	313	250
	Pa.	Lock Haven	Clinton	R	-	210
	Pa.	Meadow Grounds	Fulton	R	3,300	204
	Pa.	Warrier Ridge	Huntingdon	P	9,750	175
	Pa.	Raystown	Huntingdon	P	9,750	600
	Pa.	Shaver Creek	Huntingdon	R	1,300	72
	Pa.	Little Pine Creek	Lycoming	F,R	24,800	634
	Pa.	Water Supply Dam	Lycoming	M	1,720	61
	Pa.	Laurel Creek	Mifflin	M	3,250	67
	Pa.	#6 Res.	Northumberland	M	4,330	185
	Pa.	#2 Res.	Northumberland	M	1,920	65
	Pa.	Stillwater	Susquehanna	M	1,060	164
	Pa.	Tangley Lake	Susquehanna	MP	1,100	43
	Pa.	Big Elk Lake	Susquehanna	MP	2,580	84
	Pa.	Silver Lake Dam	Susquehanna	R	3,340	83

TABLE 3-6 (Cont'd)
NON-FEDERAL IMPOUNDMENTS - WATER SUB-REGION B

Basin	State	Name of Reservoir	County	Purpose	Total Storage Acre-ft.	Surface Area Acres
Susquehanna (Cont'd)						
	Pa.	Sunbury Fabridam	Snyder	R	-	3,000
	Pa.	Little Buffalo Creek	Perry	R	1,200	88
	Pa.	Hills Creek	Tioga	R	3,000	137
	Pa.	Horton Dam	Susquehanna	R	1,640	33
	Pa.	Lake Corey	Wyoming	R	4,000	263
	Pa.	Lake Winola	Wyoming	R,P	6,080	190
Delaware						
	N.Y.	Pepacton	Delaware	M	453,880	6,400
	N.Y.	Cannonsville	Delaware	M	280,000	5,376
Oswego						
	N.Y.	City of Ithaca	Tompkins	M	780	60

1/ F - Flood Control; FH - Fish propagation; M - Water Supply;
R - Recreation; P - Electric Power; MP - Mechanical Water Power

TABLE 3-6a
NON-FEDERAL LOCAL PROTECTION PROJECTS - WATER SUB-REGION B

PENNSYLVANIA

Location	County	Type Project
Susquehanna River Basin		
Everett	Bedford	Levee
Athens	Bradford	Levee
Sayre	Bradford	Levee, Bank Stabilization
Barnesboro	Cambria	Levee, Channel Improvement
Patton	Cambria	Channel Clearing and Improvement
Milesburg	Centre	Channel Improvement
Huntington-Smithfield	Huntington	Levee, Channel Improvement
Danville	Montour	Levee
Milton	Northumberland	Stabilization
Tioga	Tioga	Levee, Channel Improvement
Ohio River Basin		
Boynton	Somerset	Levee
Confluence	Somerset	Levee
Lockwood	Somerset	Levee, Channel Improvement
Winber	Somerset	Levee, Channel Improvement

Municipal Water Supplies

An inventory of municipal water supplies made for the Appalachian Regional Commission by the Brunswick Corporation indicates several hundred water supply systems in Water Sub-region B. In Water Area B-1 (see Page 3-47 for explanation of water areas), water use by municipalities and industry is concentrated at Binghamton, New York, and many moderate-sized communities. Drilled wells and the Susquehanna and Chemung Rivers are the principal sources. Water supply needs in 1960 were 152 million gallons per day (MGD) for the municipalities and industry.

In Water Area B-2, water use is concentrated in the Altoona-Johnstown complexes and moderate-sized communities throughout the area. Largest industrial users are the paper and chemical industries. Total municipal and industrial water use in Water Area B-2 in 1960 averaged 223 MGD. The greatest single user, nearly ten percent of the total, was a chemical plant in Northumberland County.

Water supply use by municipalities in Water Area B-3 is dispersed between many small to moderate-sized communities. The largest use of industrial water is for the manufacture of chemicals and paper in the North Branch of the Potomac. The municipal and industrial use averaged 132 MGD in 1960.

The following tabulation presents an inventory of water supply sources for cities exceeding 5,000 population in Water Sub-region B.

MUNICIPAL WATER FACILITIES - CITIES EXCEEDING 5,000 POPULATION

City	Est. Pop. Served	Source of Supply	Average Plant Output MGD
		NEW YORK	
Binghamton	108,900	Susquehanna River	10.0
Endicott	47,000	Wells	10.0
Johnson City	25,000	Wells	6.0
Norwich	8,945	Ransford Cr., Chenango Lake	1.5
Elmira City	76,310	Chemung R., Hoffman Cr., Wells	8.0
Horseheads	7,200	Wells	1.1
Cortland	20,000	Wells	3.3
Hamilton	5,900	Payne Brook	0.6
Oneonta	15,000	Oneonta Cr.	2.5
Bath	5,000	Wells	0.7
Corning	18,400	Wells	6.0
Hornell	15,000	Carrington Cr., Wells	2.3
Owego	6,500	Wells	1.0
Waverly	6,000	Dry Brook	0.6

MUNICIPAL WATER FACILITIES - CITIES EXCEEDING 5,000 POPULATION (Cont'd)

City	Est. Pop. Served	Source of Supply	Average Plant Output MGD
		PENNSYLVANIA	
Altoona	99,000	Mill Run, Homer Gap Run, Burgeon Run	13.6
Hollidaysburg	6,000	Blair Gap Run, Roaring Run, Dry Gap Run	1.0
Tyrone	11,000	Sinking Run	7.5
Sunbury	19,000	L. Shamekin Cr.	3.4
Huntingdon	11,000	Stand. Stone Cr.	1.6
Mt. Union	7,600	Dark Hollow Run, W. Licking Cr., Singers Gap Run	0.6
Lewistown	25,000	Coopers Run, Laurel Run, Lingle Run, Treaster Run, Minehart Run	32.0
Bellefonte	14,600	Bellefonte Spring	4.2
State College	36,400	Roaring Run, Wells	4.3
Lock Haven and Mill Hall	30,000	McElhattan Run, Harveys Run, Well; Rams Hollow Br., Jerry Hollow Br., Axe Factory Run, Wells	56.0
Montoursville	5,000	Wells, Springs	1.1
Williamsport	66,000	Mosquito Cr., Hagerman Run, Wells	9.0
Lewisburg & Milton	25,000	Spruce Run, White Deer Cr.	5.5
Sayre	21,000	Susquehanna River	2.8
Towanda	6,000	Satterlee Run, Wells, Springs	1.7
Berwick	25,000	Glen Br., Susquehanna R., Wells	3.9
Bloomsburg	12,300	Fishing Cr.	4.0
Danville	11,500	Susquehanna	28.1
Mt. Carmel	12,000	Springs	0.9
Northumberland	5,000	Johnson Run, Wells, Springs	0.4
Shamokin	60,000	S. Br. Roaring Cr., Trout Run	10.8
		MARYLAND	
Cumberland	50,000	Evitts Cr., Gordon & Koon Lakes	13.2
Hagerstown	85,500	Potomac R. & Mountain Springs	6.7
		WEST VIRGINIA	
None			

SECTION II - SOCIO ECONOMIC STRUCTURE

4. INTRODUCTION

Planning Devices

Various sets of geographical sub-regional delineations provide an organizational framework for the collection, analysis and presentation of data for Sub-region B. The "sub-regionalizations" are defined and their functional roles explained in Chapter 2 of Appendix E. Sub-region B is divided into three water areas designated B-1, B-2, and B-3. It also is divided into 7 State Planning Sub-regions. Water Area B-1 encompasses 16 counties, 11 in New York and 5 in Pennsylvania, and contains State Planning Sub-regions 2 and 9 and a portion of State Planning Sub-region 1. Water Area B-2 encompasses 17 counties in Pennsylvania and contains State Planning Sub-regions 7 and 8. Water Area B-3 encompasses 11 counties, 8 in West Virginia and 3 in Maryland, and contains State Planning Sub-regions 19 and 37.

The Office of Business Economics has regionalized the counties of Appalachia into a series of economic sub-regions, utilizing various measures of economic homogeneity and interdependence. Water Sub-region B also falls completely within Economic Sub-regions 1, 3, 4, 5, 6, and 10. The boundaries of water areas, state planning sub-regions, and economic sub-regions for Water Sub-region B are shown in Figure 3-13.

Within each of the state planning sub-regions, the States, as part of their Appalachian development plans, have designated one or more areas of significant potential for future growth (growth areas). Such areas have been defined by the Appalachian Regional Commission as follows:

"An area consisting of an urban center or centers and their hinterland where the state has determined significant future growth is likely or can be induced.

By a center or centers is meant a complex consisting of one or more communities or places which, taken together, provide or are likely to provide a range of cultural, social, employment, trade, and service functions for itself and its associated rural hinterlands. Though a center may not be fully developed to provide all these functions, it should provide, or potentially provide, some elements of each, and presently provide a sufficient range and magnitude of these functions to be readily identifiable as the logical location for many specialized services to people in the surrounding hinterland."

The boundaries and identification number of the various planning sub-regions, along with their key growth centers, are shown on the following page:

PRECEDING PAGE BLANK-NOT FILMED

Water Area	State Planning Sub-region Number	State	Economic Sub-region	Growth Centers
B-1	1	NY	1	Elmira-Chemung River Valley
	2	NY	1	Binghamton
	9	Pa	1&3	Chemung River Valley
B-2	8	Pa	3,4&5	State College-Williamsport
	7	Pa	5&6	Johnstown-Altoona
B-3	37	Md	5	Cumberland-Frostburgs-Hagerstown-Martinsburg
	19	W. Va.	5&10	Hagerstown-Martinsburg

In general, the Appalachian Regional Commission has been concerned with immediate and near future problems, whereas water resources analysis requires projections of 50 to 100 years in the future. As a result, the best current data available is that prepared by the ARC, and the long-range projections are those prepared by the Office of Business Economics for the Corps of Engineers and the benchmarks prepared therefrom by the Office of Appalachian Studies. The projections are by water sub-region and areas, while the ARC data is by state planning sub-regions.

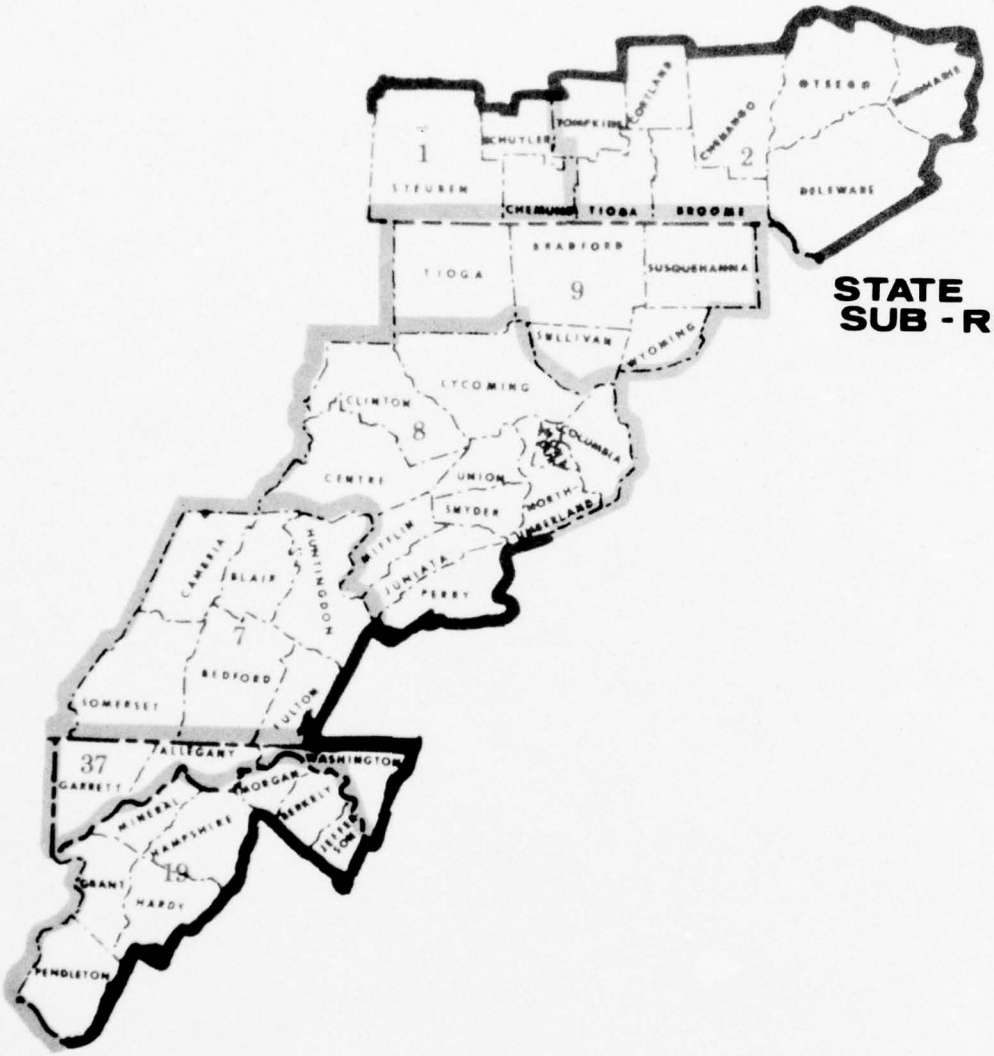
In this chapter ARC data are utilized; therefore, the information is presented by state planning sub-regions and their associated growth centers. The long-range projections by water sub-regions and water areas follow in Chapter Four.

Growth centers are emphasized in this chapter; however, it should be noted that not all projects for water resources development will be located at these centers. There are some areas, not now recognized as growth centers, which may have developmental potential with a water resource project. Also, some projects serve wide regional interests and thus are not strictly related to local Appalachian growth centers. Examples are found in a hydroelectric power project or a major upstream development that would provide flood control, water supply or water quality control for a downstream urban area outside of Appalachia.

The following paragraphs discuss the socio-economic characteristics of the water sub-region; then go on to a more intimate analysis of each state planning sub-region.

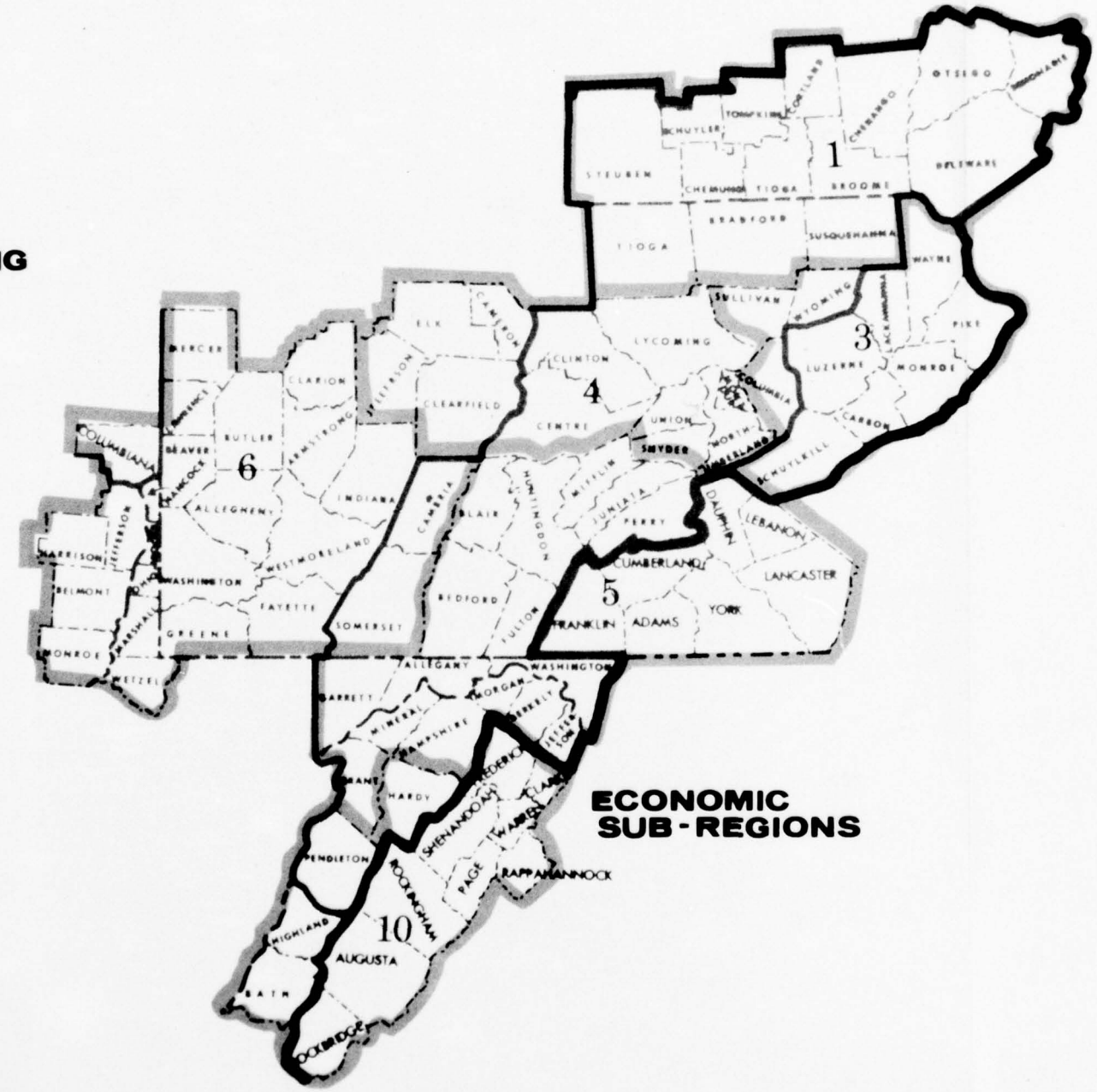
Economic Characteristics

The percent of the work force in manufacturing and agriculture is higher than the U. S. averages. About 33 percent of the work force of Sub-region B is engaged in manufacturing and 8 percent in agriculture. Highest manufacturing employment is in Water Area B-1 in the New York State economic centers and lowest in Water Area B-3



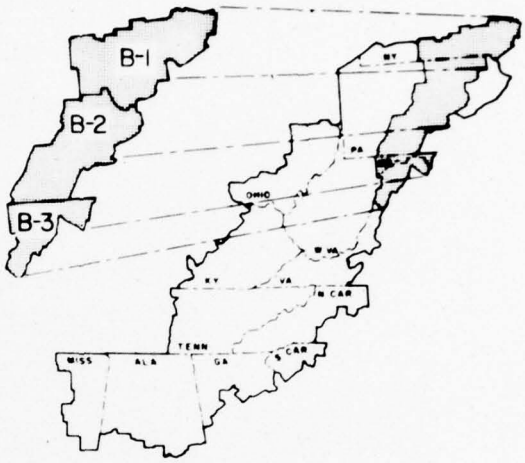
STATE PLANNING SUB-REGIONS

PLANNING
EGIONS



2

ECONOMIC SUB-REGIONS



VICINITY MAP

LEGEND

APPALACHIAN REGIONAL BOUNDARY

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION B

PLANNING AREAS

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-3-47 **FIGURE 3-13**

3

in Maryland and West Virginia where agriculture employs a larger part of the labor force. Dominant manufacturing activities are: shoes, photographic equipment, furniture, electronic equipment, pharmaceuticals, glass products, aircraft parts, clothing and machinery. There are also important research activities in the sub-region, carried out by a score of components.

In the period from 1958 to 1963 the value added growth rate has been below the U.S. average, as shown in the table below. State Planning Sub-region 37 (Maryland) had the greatest increase among these smaller regions -- 165 percent. The smallest increase occurred in State Planning Sub-region 2, with 18.1 percent. Generally the less industrialized areas experienced the greatest rate of increase, while those areas already industrialized experienced the greatest rate of increase, while those areas already industrialized experienced a slower growth rate, but had larger absolute gains.

Area	Dollar Increase Millions	Percent of Area's Share 1958	1963	Percent Increase 1958 to 1963
United States				35.7
Water Sub-region B	$15.8 to $20.8	100.0	100.0	31.8
Water Area B-1	6.9 8.2	43.6	39.3	19.8
Water B-2	6.9 9.3	43.7	44.9	33.4
Water B-3	2.0 3.3	12.7	15.8	67.8

In the decade to 1960, manufacturing employment in Water Sub-region B increased by 17.3 percent. This is lower than the U.S. average of 20 percent. Water Area B-3 had only a 6.8 percent increase. Attempts are being made to correct past deficiencies in type of industry, seasonal fluctuations, and skill mix of the labor force. Figure 3-14 gives 1960 percent employment by industry.

The greatest increase, 165 percent, occurred in State Planning Area 37, the Maryland Counties. The smallest in State Planning Area 2 the more highly industrialized area with an 18.1 percent increase. The rate of growth is considerably greater in the least developed area although the absolute growth may be relatively small.

Agricultural, forestry, and fishery employment ranges from 4.7 percent of total employment in State Planning Area 7 to 17.0 percent in Area 9. In Water Area B-1 and B-3, 9.2 percent of the employed are in this category, and in B-2, 5.6 percent are thus occupied. From 1950 to 1960, employment in this sector dropped 34.8 percent in the sub-region, compared with 38.2 percent for the United States. Agriculture and forestry now make up 7.5 percent of the total labor force compared to 6.6 for the nation.

Almost two-thirds of the sub-regions 18.2 million acres of land are in forest cover of which 98 percent is classified as commercial (see Appendix A, particularly Tables I, VIII, IX, and X for more details).

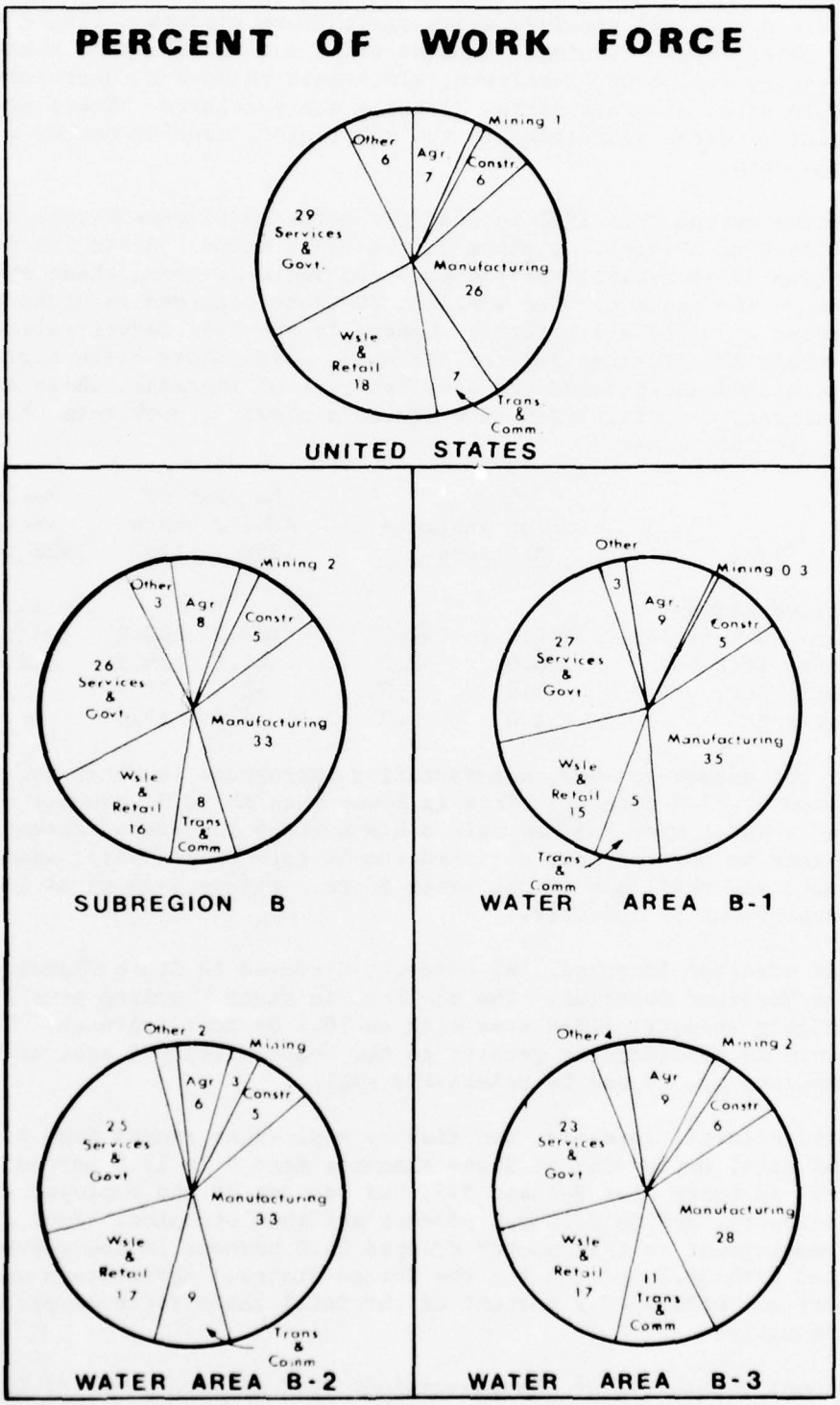
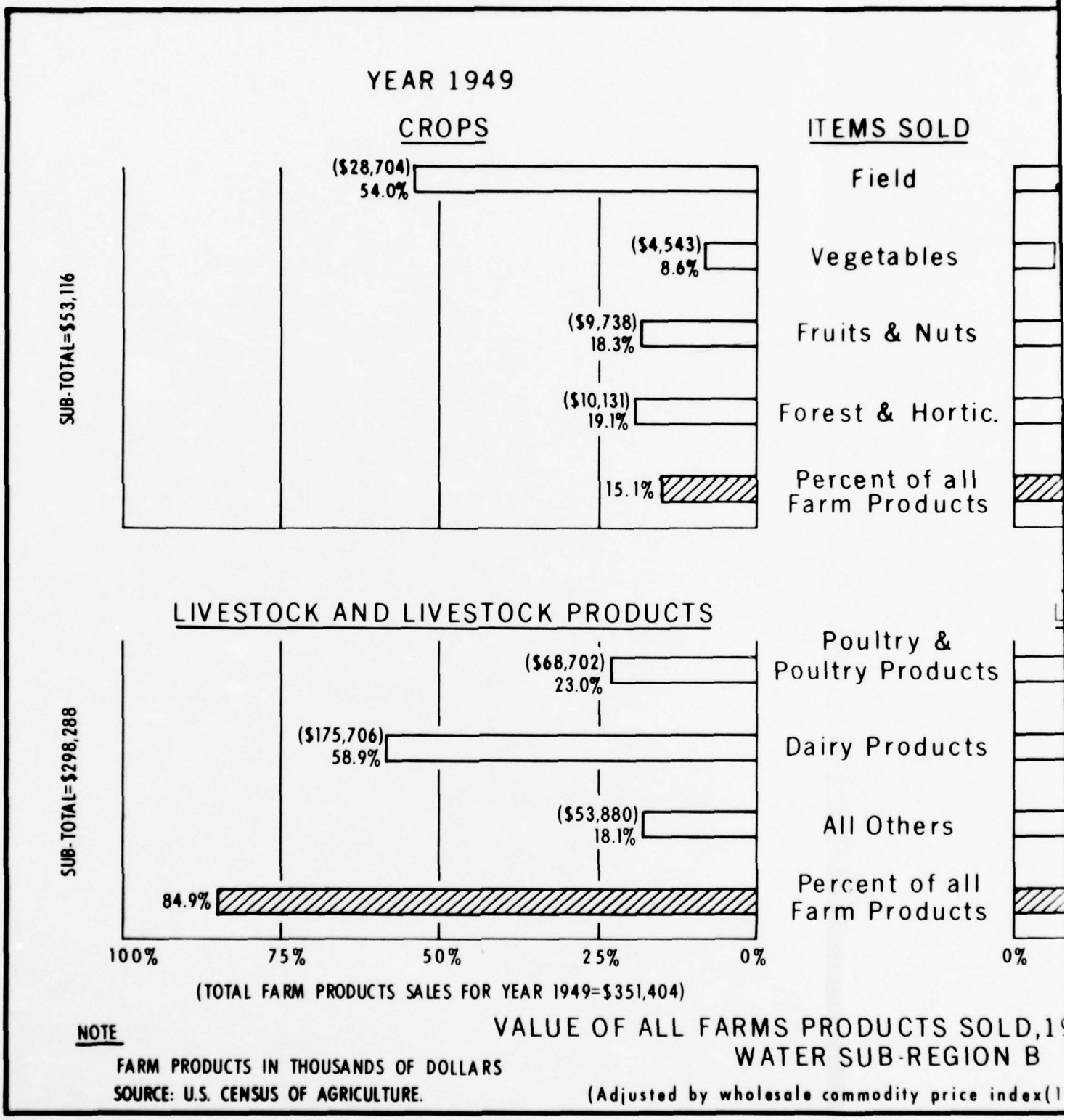


FIGURE 3-14 - EMPLOYMENT BY INDUSTRY, 1960.



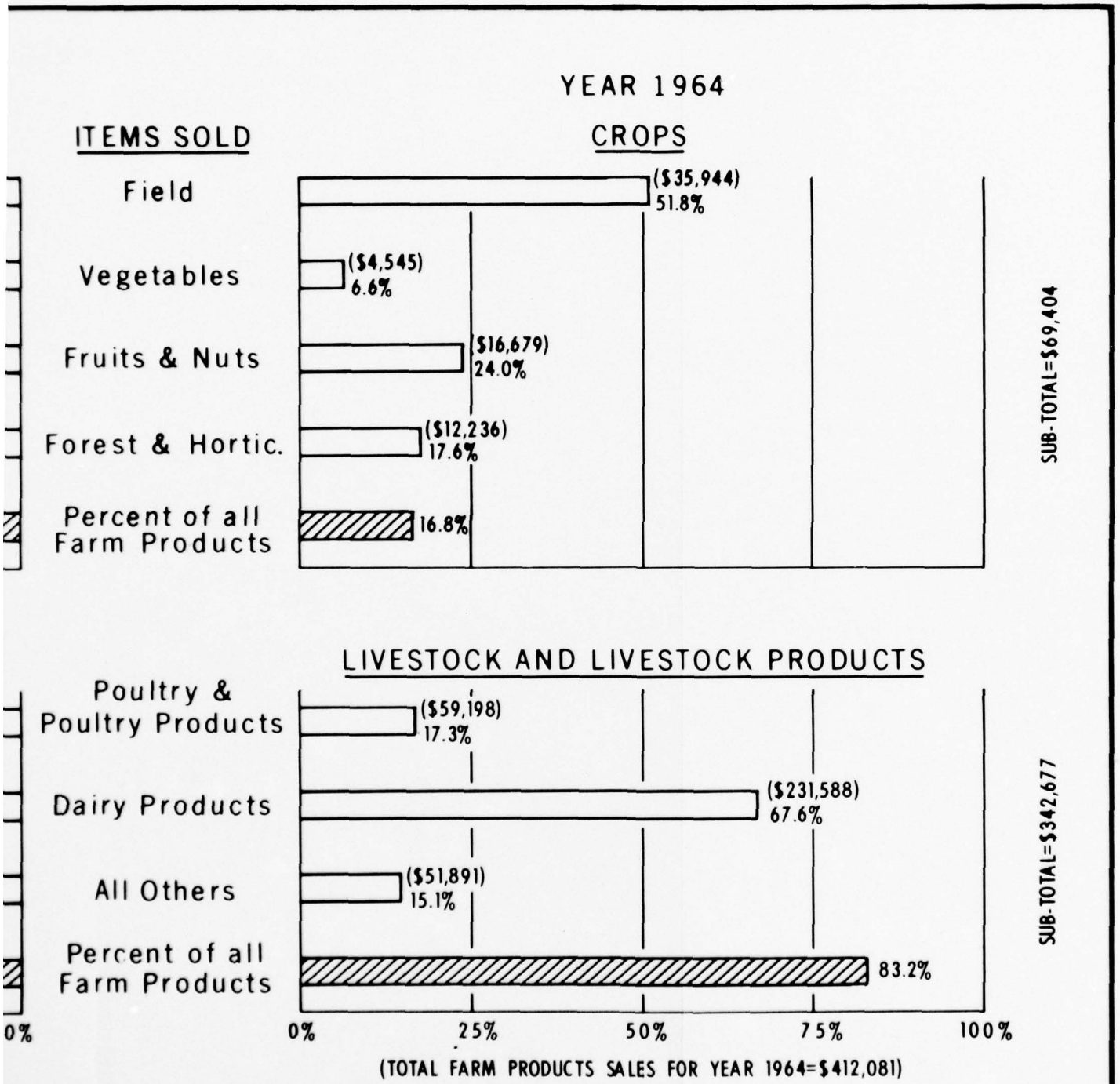
NOTE

FARM PRODUCTS IN THOUSANDS OF DOLLARS

SOURCE: U.S. CENSUS OF AGRICULTURE.

VALUE OF ALL FARMS PRODUCTS SOLD, 1
WATER SUB-REGION B

(Adjusted by wholesale commodity price index(



RMS PRODUCTS SOLD, 1949 AND 1964
WATER SUB-REGION B

holesale commodity price index(1957-59=100))

2

In 1962, the Sub-Region had 11,071 million cubic feet of merchantable timber. Hardwood growing stock comprises 9,943 million cubic feet and softwoods 1,128. Hardwood sawtimber accounts for 17,410 million board feet and softwood 2,784. About 47 percent of the commerical forest area is less than 70 percent stocked with growth stock trees. The net annual cut from growing stock is 129 million cubic feet. In 1962, the volume of timber products output was 65 million cubic feet of sawlogs, veneer logs and miscellaneous products; 49 million cubic feet of pulpwood and 25 million cubic feet of fuelwood. The total estimated value of the output was $39.9 million.

The U.S. Department of Agriculture reported that agricultural sales from Water Sub-region B increased from $351.4 million in 1949 to $412.1 million in 1964, based on 1957-59 prices. Of the various commodity sales, dairy products and fruit showed the largest increases. This, and the value of other agricultural commodities sold from the water sub-region are shown in Figure 3-15 on page 3-51.

Transportation, communications, and utilities have also experienced significant decreases in employment in all water areas of Sub-region B. From 1950 to 1960, the overall decline in employment was 20.8 percent, distributed as follows: Water Area B-1, minus 20.4 percent; B-2, minus 24.0 percent; and B-3, minus 10.8 percent. Cumberland and Hagerstown, Maryland, and particularly Altoona, Pennsylvania, have been major routing and repairing centers for the Baltimore and Ohio, Western Maryland, and Pennsylvania Railroads. The development of the diesel engine, increasing mechanization, and decreasing passenger traffic have all contributed to a decline in labor needs. In Blair County, Pennsylvania, where Altoona is located, transportation industry employment declined almost 40 percent. Since 1963, there has been some reversal of this decline, and the recent merger of the New York Central and Pennsylvania Railroads may help strengthen the recent upward shift.

Wholesale and retail trade presents a mixed picture, with a modest gain in employment of 3.9 percent over the decade. This is significantly behind the 11.4 percent increase for the United States.

Mining has experienced a rapid employment decline. Employment has dropped from 4.9 percent of the labor force to 1.8 percent. Eighty percent of the mining employment is concentrated in Water Area B-2. The decline of mining jobs in B-2 was the greatest of all areas, amounting to a decrease of 66.6 percent of 1950 mining employment, as compared to 48.4 percent in B-3, and only 9.1 percent in B-1. However, from 1961 to 1965, production from mines has increased 27 percent, from $153 million to $210 million. Employment pertaining to salt, limestone, sand, clay, and stone is growing more rapidly.

Contract construction employment trends vary greatly throughout the sub-region. The share of total employment in contract construction ranged from 4.9 percent for State Planning Sub-region 1 to 6.8 percent in State Planning Sub-region 19. For Sub-region B, the proportion was 5.4 percent in 1950 and 5.3 percent in 1960. This is above the United States proportion of 4.3 percent, but below the Appalachian rate of 5.7 percent.

The public and private services category has made the largest advance with a 26.6 percent increase in Sub-region B, but still is below the 33.7 percent increase for the United States. All the water areas made substantial gains: Sub-region B's share went from 20.9 to 25.6 percent, while the United States increase went from 25.3 to 29.3 percent.

The growth rate in employment in services in the United States was four and one-half times that of Sub-region B. The program of heavy public investment for Appalachia will undoubtedly increase employment in services. The low urbanization rates in the sub-region mean fewer service jobs and more employment in those sectors for which this area has a natural endowment, such as mining and agriculture. Although it is the objective of the Appalachian Act to bring this area up to the general economic level of the nation as a whole, it is not implicit that the structure of the economy must be the same.

In 1960, Sub-region B was characterized by higher unemployment rates than the nation, and a higher proportion of individuals who were not in the labor force. Sub-region B's unemployment rate in 1966 was only a fraction above that for the nation. Obviously, the prosperity of the national economy in this period had its effect in this portion of Appalachia. Unemployment rates by counties are depicted in Figure 3-16.

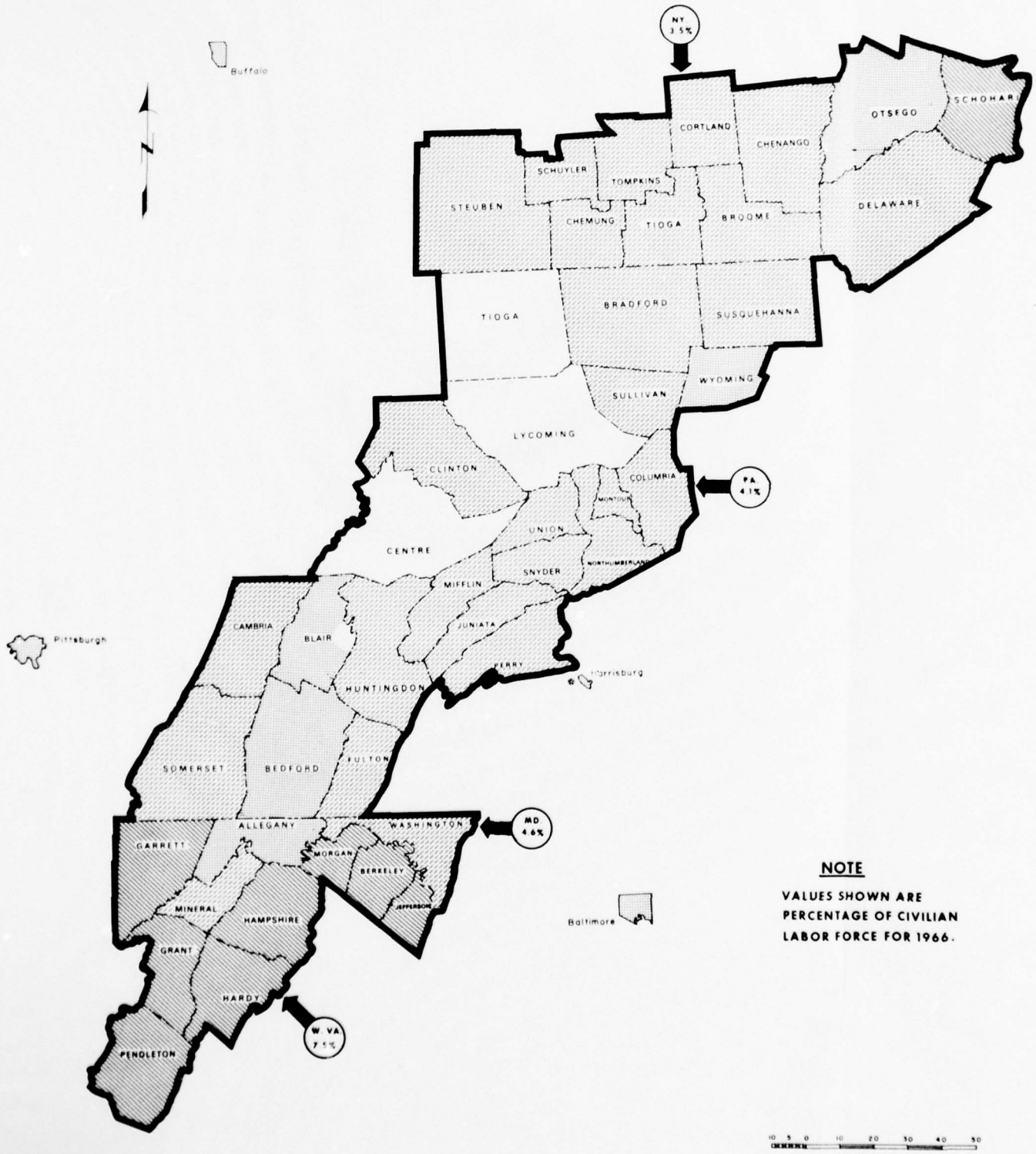
Per capita income in Sub-region B was $1,569, 85 percent of the United States level of $1,850, but it was nine percent above the Appalachian Area figure of $1,436. Moving southwest from New York, a general pattern of decreasing income is encountered. Per capita income in 1959 for Sub-region B-1 was $1,731; in B-2, it was $1,470; and in B-3, it was $1,442.

The lowest level was recorded in Pendleton County, West Virginia, with $789. The top of the range is found in Broome County, New York, with $2,021.

Median family income in Sub-region B in 1960 was $5,032. This was 85 percent of the national level of $5,660 for that year. The range and pattern of this indicator were similar to those of per capita income. Median family income for Water Area B-1 was $5,582; for Water Area B-2, it was $4,785, and for Water Area B-3, it was $4,560. Grant County, West Virginia, had the lowest median family income with $2,347. The top of the range is again found in Broome County, New York, with $6,409.

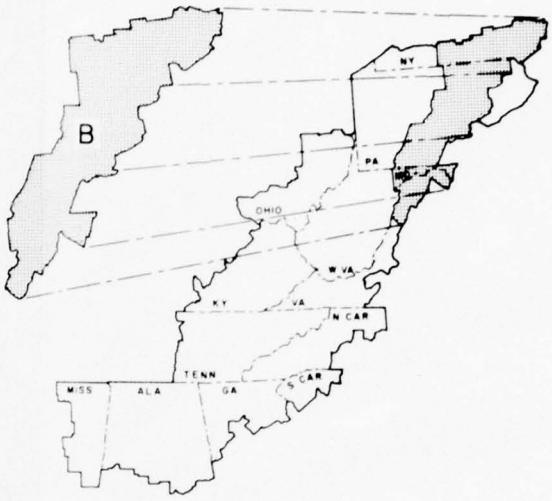
Figure 3-17 (Page 3-57) shows the income distribution in Sub-region B. The industrial structure, the demographic structure and urban-rural split, the educational attainment of the population, and many other socio-economic factors bear a direct relationship to the number of families with low incomes.

It can be seen that from New York State southwestward, the percentage of those living below the $3,000 poverty level increases dramatically. The income range $3,000 to $6,000 may be considered



NOTE

VALUES SHOWN ARE PERCENTAGE OF CIVILIAN LABOR FORCE FOR 1966.



VICINITY MAP

LEGEND

- COUNTIES HAVING LESS THAN 3.0%
- COUNTIES HAVING 3.0%-4.9%
- COUNTIES HAVING 5.0%-6.9%
- COUNTIES HAVING 7.0% -14.9%
- PERCENT OF UNEMPLOYMENT BY PORTION OF STATE SHOWN

NOTE

VALUES SHOWN ARE PERCENTAGE OF CIVILIAN LABOR FORCE FOR 1966.

10 5 0 10 20 30 40 50
SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION B

UNEMPLOYMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-3-55 FIGURE 3-16

2

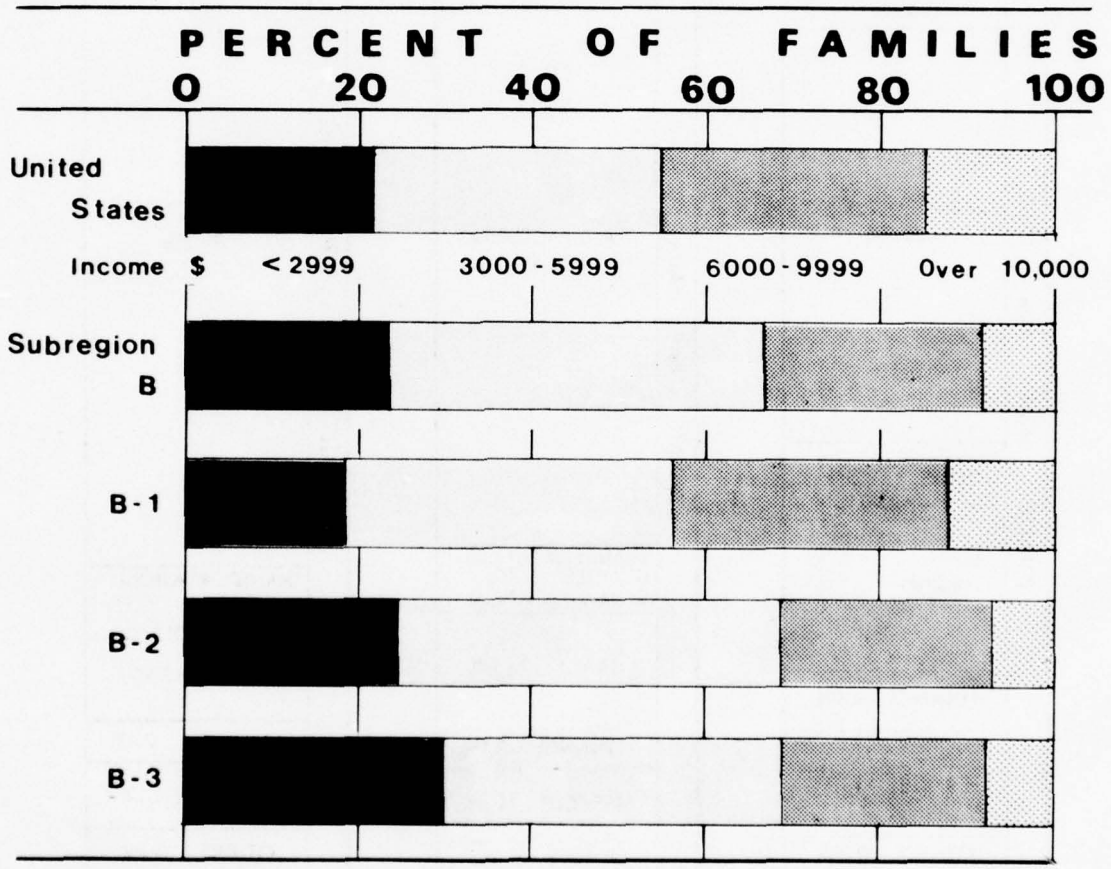


Figure 3-17 - Income Distribution - 1960 - Sub-region B

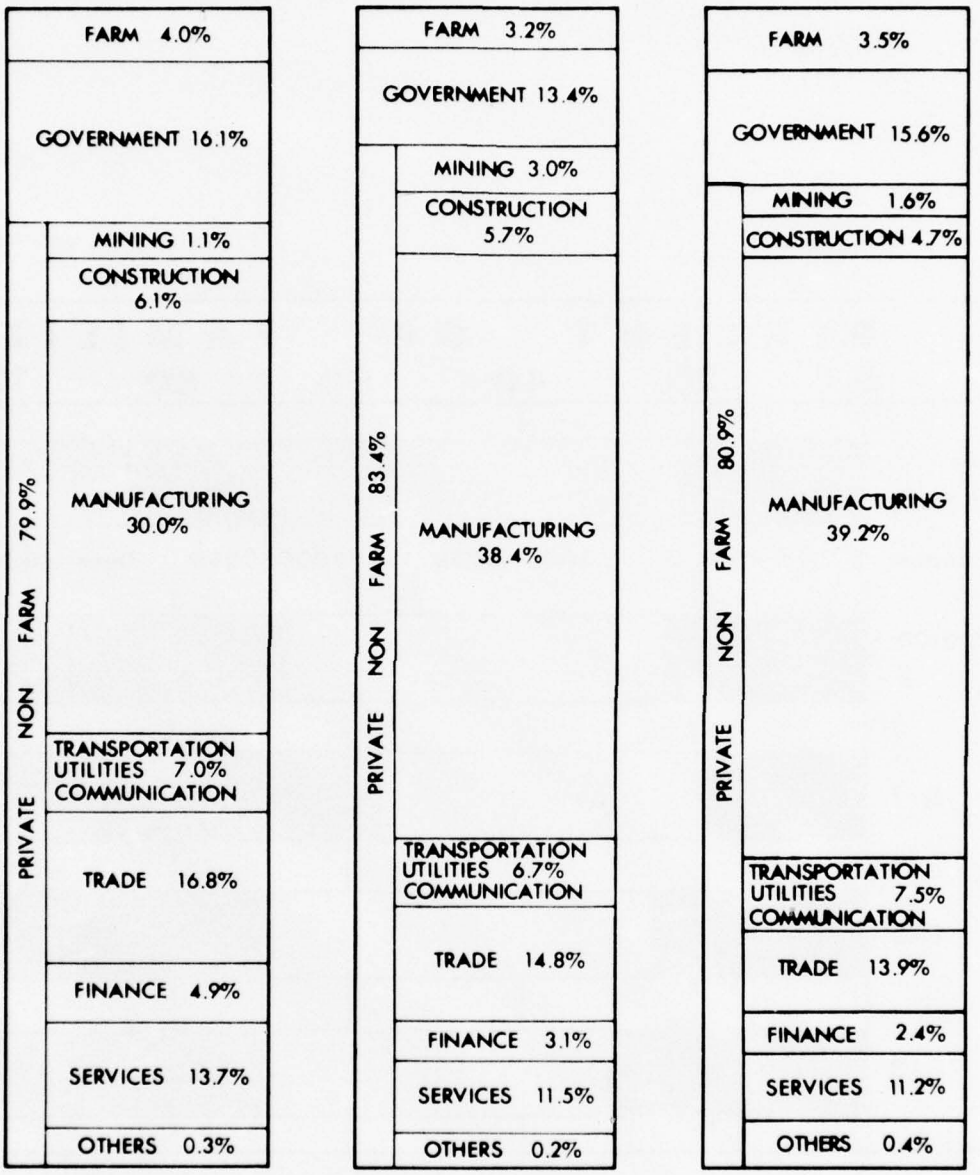


FIGURE 3-18, SOURCES OF INCOME, 1966

as somewhat above subsistence level, although barely adequate to support a family. Here then is the core of the problem in Sub-region B. There is an urgent need to increase opportunities through better education, through improved transportation to work locations and through attraction of higher wage industries. Water of good quality would help attract industry and develop recreational areas.

The source of income for the sub-region is depicted in Figure 3-18 (Page 3-58) which shows the percent of earnings by broad industrial sector for Sub-region B, Appalachia, and the United States. Most of the employment sectors for the sub-region is similar to those for Appalachia as a whole. Compared to the U.S., the sub-region is higher for manufacturing and lower for the trade and service sectors.

Although detailed data on the balance of trade position of Sub-region B are not available, it is in a better position than most other Appalachian areas. It has several urban communities with well established nationally based firms. Its full use as an eastern recreation area has yet to be realized, although this is already an important source of income. The Eastern Panhandle of West Virginia is the area with the weakest economic base at present. At the other end of the spectrum are the Binghamton and Elmira, New York areas with a strong group of high wage industries and the human resources to attract further development. In between are the many areas of Pennsylvania and Maryland that are now going through a period of readjustment from single- or dual-industry economies to a more diversified economy.

Approximately 1,793,000 acres of forest land in the sub-region are in public ownership (6 percent of the total land area). National Forests administer about 183,000 acres which are all available for recreational use. To help sustain the local tax base, it is the policy of the Federal Government, that maintains and manages the National Forests to return about 25 percent of all revenues to the counties concerned.

Capital Availability

The Federal Government has underwritten ninety percent of the cost of the Interstate Highway System. The Appalachian Act of 1965, under which this report is being written, provides funds for a wide range of developmental investments. Many projects have been approved in Sub-region B. These include: local access roads, airports, libraries, hospitals, sewage treatment plants, educational institutions, sewerage systems, nursing homes, industrial parks, community centers, and mine drainage abatement. Almost every Federal department has some program to help build projects in cooperation with state and local government.

Each state has a number of programs for providing capital for public and private development. Pennsylvania has an excellent financing program for industry through the Pennsylvania Industrial Development Assistance Act of 1956 which created the Pennsylvania Industrial Development Authority (PIDA). This program provides financing for development in hardship areas. A first mortgage loan

for 50 percent must be obtained from a regular lending institution at prevailing interest rates; a second mortgage of 40 percent may then be obtained from PIDA at 2 percent interest; the remaining 10 percent may be supplied by the local industrial development agency. A number of other ways are used to obtain financial aid for development. Non-profit development corporations provide capital for industrial, commercial, and recreational development. They usually can issue bonds, own and develop land and utilities, and obtain funds through government programs at all levels. Other methods of stimulating the economy include various tax relief schemes, development of amenities, and special rates for public utilities. Nevertheless, financing in any particular area depends upon interested local parties setting up the required machinery.

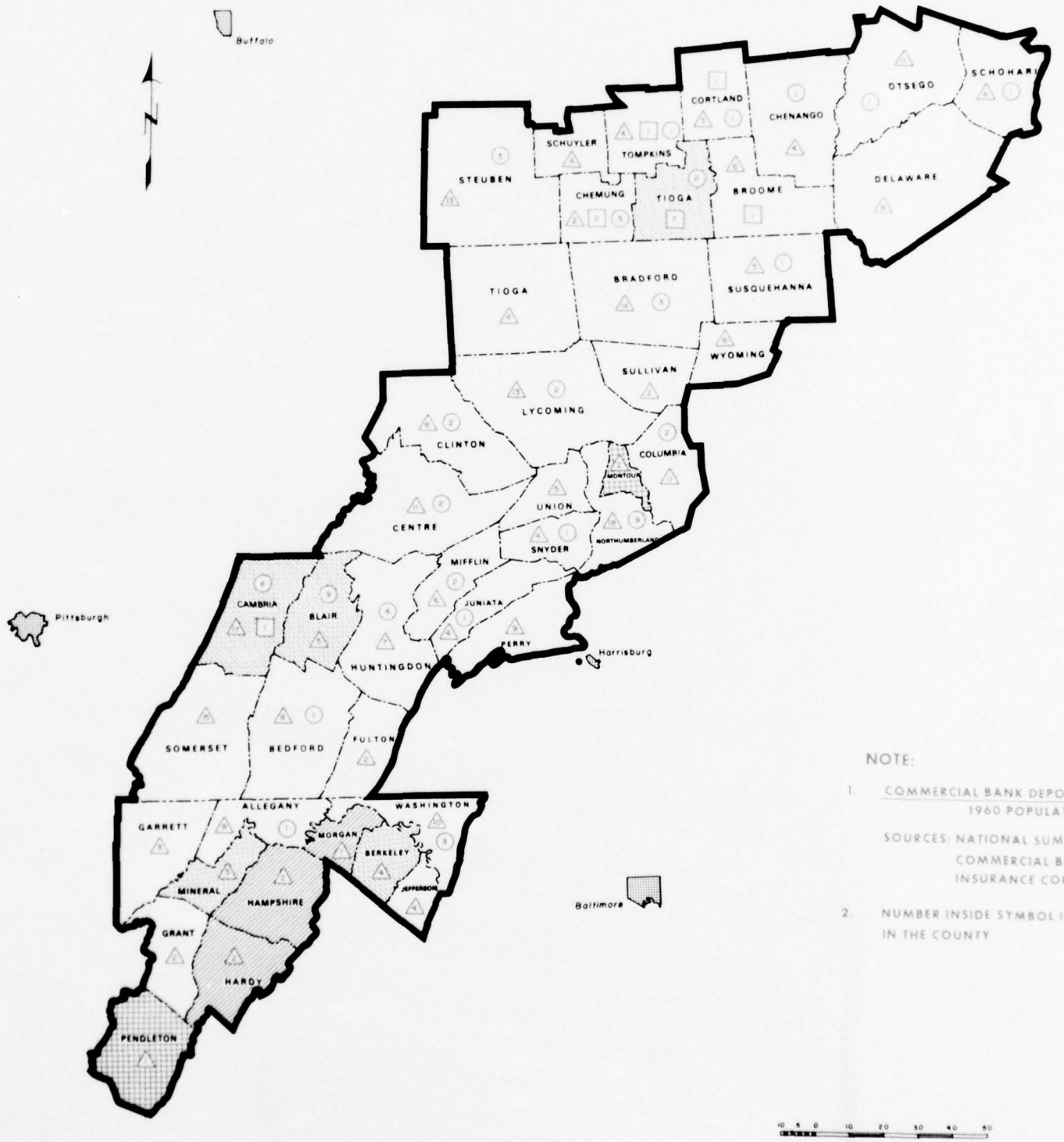
On the private level, lending policies reflect local public attitudes. Bankers in progressive communities generally have more liberal lending policies and actively seek investment that will benefit their area. On the other hand, lenders in some less progressive communities will be very cautious. Figure 3-19 depicts one aspect of the financial situation in the water sub-region.

Local Attitudes

In Water Area B-1, the residents have shown a great capacity to apply intelligent initiative toward improving living standards. This region has the advantage of having two major urban areas with growing and increasingly diversified economies. The Pennsylvania portion (State Planning Sub-Region 9), although highly rural in nature, is being guided to develop its natural advantages as a source of labor for the surrounding cities, as a milk producing area for the Philadelphia and New York City markets, and as a recreation center for the entire northeast. Upstate New York rural counties and small towns are now in various stages of planning for an improved economic and physical environment.

In Water Area B-2, many communities have active planning and development programs based on positive attitudes toward improvement.

Water Area B-3 also displays an uneven acceptance of change and development. Growth is, however, taking place in Maryland and adjacent counties of West Virginia. The South Branch Potomac River residents favor the present rural character of the area, but there has been some recent industrial development in the Petersburg, West Virginia area. Unless this trend is encouraged, the younger generations with ability will continue to leave this area. The people in the area of the North Branch Potomac River and along the main stem of the Potomac River, have shown great initiative in developing this area for industrial activity and recreational enjoyment.

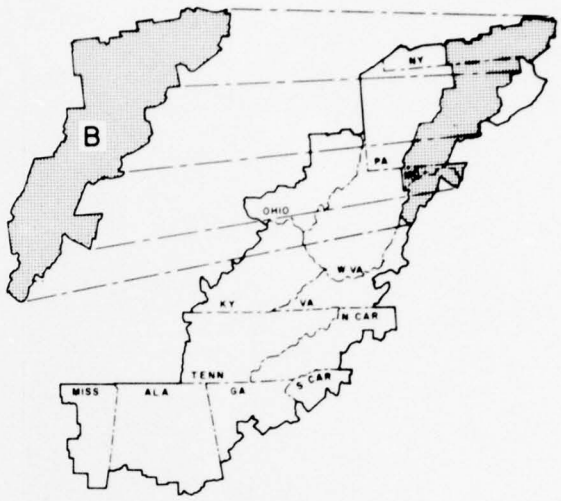


NOTE:

1. COMMERCIAL BANK DEPOSITS
1960 POPULATION

SOURCES: NATIONAL SUMMARY
COMMERCIAL BANKS
INSURANCE CORPOR

2. NUMBER INSIDE SYMBOL INDIC
IN THE COUNTY



VICINITY MAP

LEGEND

- (2) SAVINGS & LOAN ASSOCIATIONS
- △5 COMMERCIAL BANKS
- [1] MUTUAL SAVINGS BANK

BANK DEPOSITS, PER-CAPITA BY COUNTY:

- $300-$499
- $500-$799
- $800-$999
- $1000-$1499

NOTE:

1. $\frac{\text{COMMERCIAL BANK DEPOSITS 6/30/66}}{\text{1960 POPULATION}} =$ PER CAPITA COMM. BANK DEPOSITS

   SOURCES: NATIONAL SUMMARY OF ACCOUNT AND DEPOSITS IN ALL COMMERCIAL BANKS, JUNE 30,1966: FEDERAL DEPOSIT INSURANCE CORPORATION

2. NUMBER INSIDE SYMBOL INDICATES NUMBER OF INSTITUTIONS IN THE COUNTY

10 5 0 10 20 30 40 50
SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION B

FINANCIAL SITUATION

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-3-61 **FIGURE 3-19**

2

5. WATER AREAS

The five water areas in Water Sub-region B have been divided into seven state planning sub-regions. The delineation of state planning sub-regions within Water Sub-region B has been described and discussed in Paragraph 4, and is indicated on Figure 3-13 (Page 3-47). The state planning sub-regions are used in Sub-region B as the principal geographic division for display of economic data. Graphical comparisons of the state planning sub-regions with the water sub-region have been included in each of the following sections to aid in orienting the reader to the state planning sub-region.

Water Area B-1

Water Area B-1 contains 3 counties (Chemung, Schuyler and Steuben) of New York State Planning Sub-region 1, New York State Planning Sub-region 2 and Pennsylvania State Planning Sub-region 9.

State Planning Sub-region 1 and 2

Water Sub-region B includes all of the New York counties within State Planning Sub-region 2*/ and three counties of New York State Planning Sub-region 1 (Chemung, Schuyler and Steuben). The urban areas of

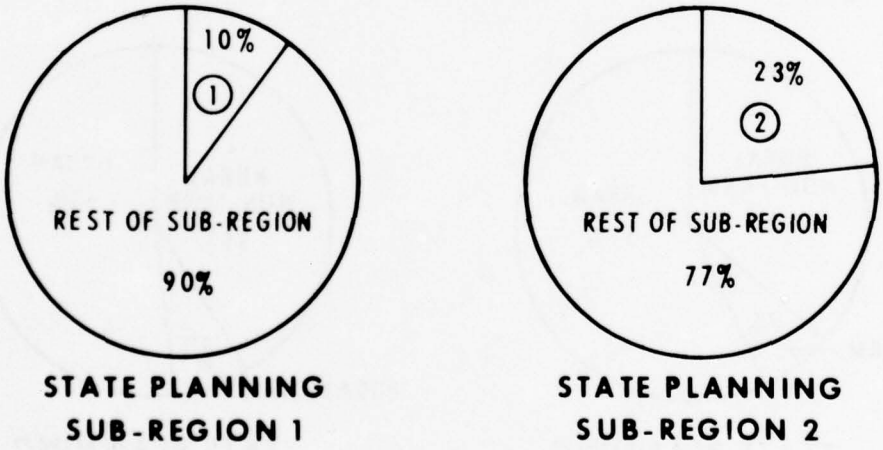
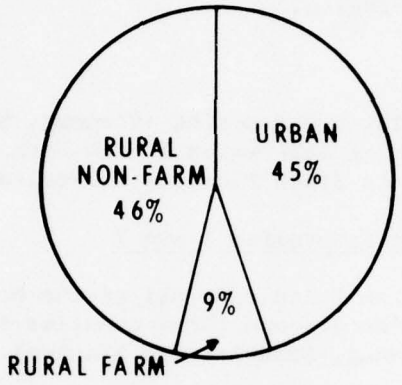


Figure 3-20 - Population in State Planning Sub-region 1 and 2 Compared to Water Sub-region B, 1965.

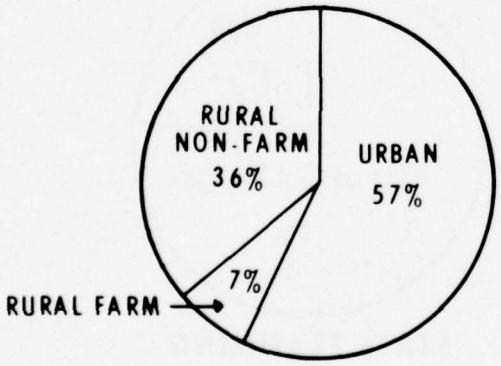
*/ New York State Planning Sub-region 2 includes eight counties: Broome, Chenango, Cortland, Delaware, Otsego, Tioga, Tompkins and Schoharie.

Elmira, Corning, Ithaca, and Binghamton provide the principal centers of employment and residence. The remaining portion of the New York area is relatively sparsely populated, reflecting the greater importance of agriculture and that traditional east-west trade routes have developed further north along the Mohawk River Valley.

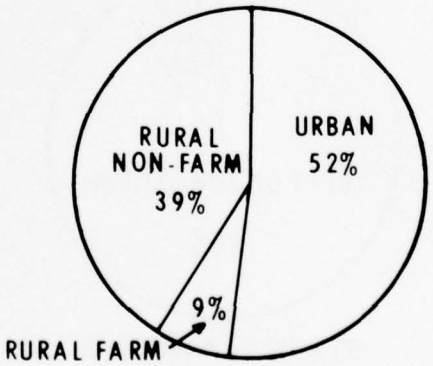
The total 1965 population of these 11 New York counties was about 763,000, of which 70 percent were within State Planning Sub-region 2 and 30 percent within the 3 counties of State Planning Sub-region 1.



WATER SUB-REGION B
1960



STATE PLANNING SUB-REGION 1 */
1960



STATE PLANNING SUB-REGION 2
1960

*/ The chart describes the population distribution in the three New York counties of State Planning Sub-region 1 which are included in Water Sub-region B: Chemung, Schuyler, and Steuben.

Figure 3-21 - Urban-Rural Population Distribution of State Planning Sub-regions 1 and 2 Compared to Water Sub-region B, 1960.

The total civilian labor force in the New York counties of Water Sub-region B in 1965 numbered about 288,000 with about 96 percent employed. In the tabulation below, employment characteristics for State Planning Sub-region 2 and the portion of State Planning Sub-region 1 in Water Sub-region B are shown for comparison.

Labor Force, Employment and Unemployment, 1965

	Civilian Labor Force (1,000)	Unemployed (1,000)	Total Employment (1,000)	Percent of Employed	
				Manufactures	Services
State Planning Sub-region 2	205.0	8.7	196.3	35.5	52.8
State Planning Sub-region 1 (Chemung, Schuyler and Steuben)	83.4	3.5	79.9	42.3	46.6

During the period 1960-1965, the population of State Planning Sub-region 2 increased about 5.7 percent and employment about 4.7 percent. Respective rates for the Water Sub-region B counties of State Planning Sub-region 1 are 4.9 percent and 9 percent, respectively.

Counties of State Planning Sub-region 1, within Water Sub-region B, experienced employment increases during the period 1960-1965 in the following manufacturing sectors; Food and Textiles; Wood and Paper; Chemicals and Petroleum; Clay, Glass, and Metals; and Machinery and Miscellaneous. In terms of absolute numbers, the most significant increase was in the Clay, Glass, and Metals employment grouping. Employment in the construction industry declined during the period.

Increases in manufacturing employment in State Planning Sub-region 2, during the period 1960-1965, were experienced in Chemicals and Petroleum (17.0 percent), Machinery and Miscellaneous (11.7 percent) and in Clay, Glass, and Metals (8.0 percent). The increase in absolute employment was greatest in Machinery and Miscellaneous activities. Manufacturing within State Planning Sub-region 2 showing percentage losses during this period were Wood and Paper (-23.3 percent) and Food and Textiles (-7.9 percent). Within State Planning Sub-region 2, employment in the construction industry declined about 26 percent.

The largest declines in State Planning Sub-region 2, in the non-manufacturing sectors from 1960 to 1965 were in Agriculture, Forestry

and Fisheries (-26.1 percent) and Mining (-25.0 percent), with a comparatively moderate decline in Transportation and Utilities (-14.6 percent) and a slight decline in Wholesale and Retail Trade (-2.9 percent). Employment in other private sectors increased 52.5 percent and the Government sector increased 17.2 percent.

Priority problems include: a deficiency in access to national markets; a need for improved technical and vocational training; and the strengthening of the urban service base in the growth centers of the area.

Past exploitation of timber and soil seriously affect some agricultural and resource development opportunities among these New York counties. With the exception of the urban areas in the Susquehanna River Basin, New York State is heavily dependent upon an agricultural economy. The reliance of rural areas on agriculture and the poor transportation network has left the rural population relatively isolated from the growth opportunities now developing in the urban centers. However, some transportation deficiencies should be corrected when limited access highways are completed. Corridor T, known locally as the Southern Tier Expressway, will run from Binghamton to the New York State line east of Erie, Pennsylvania. It connects with Interstate 81, outside of Binghamton, and it will tie in with the proposed Genesee Expressway that will lead from Bath to Rochester. At Elmira, it will connect to Corridor U, to Williamsport, Pennsylvania. Major parts of the Southern Tier Expressway are under construction or completed. State Route 17, when completed, will run from the New York State Thruway north of New York City and tie in with Corridor T at Binghamton.

Within the New York portion of the water sub-region, cities with potential for future growth have been designated as "primary centers" by the State of New York. Two primary centers are: (1) Binghamton-Johnson City-Endicott: (2) Elmira and the Chemung Valley area in New York and Pennsylvania. There are, in addition, several "secondary centers." These urban centers offer the following: a favorable industrial base, relatively good locations, institutions of higher learning, vigorous commercial activity, and numerous industrial sites.

Development problems in the New York portion of Water Subregion B include: decreasing agricultural employment, changing recreation markets and population patterns, and decreased demands for unskilled labor. Environmental conditions which contribute to the problem include poor mining and forestry practices, farming on marginal lands, water pollution, and rugged topography.

Binghamton-Owego-Susquehanna County Growth Center. The Binghamton-Owego-Susquehanna Center includes the City of Binghamton, seven surrounding towns in Broome County, the town of Owego in Tioga County and part of Susquehanna County, Pennsylvania. All of these towns and cities are located along the Susquehanna River.

Interstate Route 81 is completed from Frackville, Pennsylvania, through Binghamton to the Canadian border. Running east and west through Binghamton is the Southern Tier Expressway (Corridor "T") which extends through all of the southern counties of New York State. Binghamton is also the terminus for three other important highways, State Routes 7 and 12, and U.S. Route 11, which connect this center to the capitol area, Syracuse and Utica, respectively. Binghamton is served by the Delaware and Hudson, the Erie-Lackawanna, and the Lehigh Valley Railroads. The Broome County Airport, ten miles northwest of Binghamton, is served by one commercial air carrier. General aviation facilities are also available at the Tri-Cities Airport, three miles west of the Village of Endicott and also near Hallstead, Pennsylvania. There are two small airports near Binghamton and two near Owego.

The population of the Binghamton-Owego-Susquehanna County Center was roughly 200,000 in 1960, 15 percent more than in 1950. Although the population of the City of Binghamton declined 6 percent during this period, growth occurred in the outlying communities as a result of suburbanization and industrial expansion. This trend is continuing. A census taken in 1966 showed further population increases in all but the town of Dickinson.

The Binghamton-Owego-Susquehanna Center is a major concentration point for manufacturing activity, providing more than 45,000 industrial jobs. A major shoe manufacturer, with plants in Binghamton, Endicott, Johnson City, and Owego has long been a leading source of factory jobs. In recent years, its employment has declined substantially. A number of other industries, however, have expanded, increasing the diversification of industrial activity in and around Binghamton. Major manufactured products in the 'tri-cities" of Binghamton, Endicott and Johnson City include shoes, business machines, photographic equipment, precision ordnance equipment, aviation training equipment, furniture, electronic assemblies and wire products. In Owego, the largest manufacturing employer is engaged in the development and production of electronics products for the military. A great variety of other manufactured products are produced in the Binghamton-Owego-Susquehanna Center. In the past three years, manufacturing expansions in excess of $30 million have created well over 1.4 million square feet of manufacturing or warehousing space.

Because of the highly technical nature of much of the manufacturing activity in the Binghamton-Owego-Susquehanna Center, industrial research and development is an important activity. Research laboratories are related to space guidance systems, flight simulation, specialized computers, photography, and photocopying. Smaller laboratories conduct research in such varied fields as pharmaceuticals, electronic testing equipment, tanning and leather finishes, and paper handling equipment.

Although these laboratories employ well over 1,000 scientists, engineers, technicians and supporting personnel, their importance lies not so much in the number of jobs currently provided, but in the future growth of manufacturing jobs which may result from their activities.

The State University of New York at Binghamton increased its enrollment from 1,400 in the fall of 1960 to over 4,000 in the fall of 1966. Several million dollars in construction currently under way at the school's campus in the town of Vestal should pave the way for a further enrollment increase - to about 6,000 by 1970. Broome Technical Community College, a locally sponsored two-year college under the supervision of the State University, expanded its enrollment from about 1,500 in 1960 to almost 3,400 in the fall of 1968. The opportunities offered for higher education enhance the economic potential of the area.

There are some recreation facilities in the hinterland but more will need to be developed to meet future demands. The Chenango Valley State Park in northern Broome County had about 340,000 visitors in a recent year, representing a continued increase in the use of this park. In addition, a number of ski areas provide winter recreation.

Chemung River Valley Growth Center. The Chemung River Valley Center includes the cities of Elmira and Corning, New York; Athens and Sayre, Pennsylvania, and ten adjacent towns in the Chemung River Valley, including the Village of Waverly.

The contributory hinterland of this growth center includes all of Chemung County, most of Steuben and Schuyler Counties and parts of Tioga and Tompkins Counties, New York, and Bradford and Tioga Counties Pennsylvania. Watkins Glen, at the tip of Seneca Lake and Montour Falls, supplies workers who commute to Elmira and Corning.

The Southern Tier Expressway will serve the growth center. Important north-south highways include State Route 14, through Elmira south into Pennsylvania and north to the New York Thruway near Geneva, State Route 13 to Ithaca and Cortland, and U.S. Route 220 from Waverly south into Pennsylvania. The growth center is served by three major railroads, the Penn-Central, the Erie-Lackawanna, and the Lehigh Valley. Scheduled air carrier service is available at the Chemung County Airport, near Elmira. There are three general aviation airports, one near Painted Post and two just south across the New York-Pennsylvania border from Waverly and west of Sayre and Athens.

About 140,000 people resided in the Chemung River Valley Center in 1960, ten percent more than in 1950. Although small population declines occurred in the cities of Corning and Elmira, several adjacent towns, such as Horseheads and Big Flats, had substantial population increases. This suburban growth is apparently continuing at a rapid rate according to census taken in five towns in the growth center in 1964 and 1965.

There is considerable manufacturing activity in the Chemung River Valley Center, providing well over 35,000 jobs. The city of Elmira has a diversified industrial mix which includes the manufacture of greeting cards, motor vehicle parts, metal stampings, glass products, fire-fighting equipment, business machines, aircraft parts, frozen foods, valves, machine tools, castings, structural steel apparatus, electronic tubes, prefabricated homes and glass products, as well as a new multi-million dollar food-processing and container-manufacturing complex. Glass products are also produced in Big Flats. Painted Post has a large compressor manufacturing plant. Animal feeds and electronic equipment shelters are the chief products of Waverly, while knit underwear and metal-working machinery are produces in Athens and Sayre.

Manufacturing expansions in many millions of dollars have been completed in the past several years, or are currently planned or underway in the growth center. These expansions involve over one million square feet of manufacturing, warehousing or laboratory space and have provided or will result in the creation of more than 2,500 new jobs.

Industrial research is an important business in the Chemung River Valley Center. The largest research laboratory is part of the giant glass manufacturing complex in Corning. This laboratory employs over 800 scientists, technicians, and supporting personnel who are engaged in glass and ceramic materials research. Other laboratories do research in such varied fields as electron tube engineering, electrical components, fire extinguishing materials and apparatus, valve design and performance, glass technology, purification and filtration of industrial oils and chemicals, and internal combustion engines and other automotive systems.

There are two institutions of higher education in the Chemung River Valley Center - Elmira College and Corning Community College - with a combined enrollment of over 5,000 in 1968. Although Elmira College is primarily a women's college, its evening division is coeducational. Corning Community College, a locally sponsored two-year college under State University supervision, has grown rapidly in recent years.

Although there are many recreational opportunities in the area, they are still not adequate for the growing demand. Watkins Glen State Park in Schuyler County and Stony Brook State Park in northern Steuben County had a combined attendance of over 600,000 last year. Boating, swimming, and other water recreation is available in Keuka and Seneca Lakes, as well as a number of smaller lakes. In addition, hundreds of thousands of persons each year tour the Corning Glass Center in Corning and the wineries around Hammondsport.

Chenango Valley Growth Center. This center follows the valley of the Chenango River in Chenango County. The major urban places in this center are the City of Norwich and the Village of Greene. This center lies almost equidistant from two substantial metropolitan areas - Binghamton to the southwest and Utica-Rome to the north.

The population of the Chenango Valley Center was almost 27,000 in 1960, up more than 12 percent over 1950. The greatest relative population growth during the decade occurred on both sides of the Chenango River from Norwich north to Sherburne, and in and around the village of Greene in the southerly portion of the area.

Route 7 runs along the Susquehanna Valley from Binghamton, through Oneonta, to the capitol district. Interstate 88 will parallel Route 7, providing Binghamton, and other Chenango and Susquehanna Valley towns with quick access to the Albany Schenectady-Troy area, New England, and Canada. Route 12 runs along the Chanango Valley through Norwich to Utica. South of Utica, it connects with U.S. Route 20 leading to Syracuse. Rail service is provided by the main line of the Erie-Lackawanna Railroad. There are small commercial airports at Norwich and Greene. The contributory hinterland of this primary center includes most of Chenango County, as well as parts of adjacent counties.

The city of Norwich is the home of a major pharmaceuticals manufacturer and is also notable for a variety of other manufactures, including knit goods, children's shoes, electrical equipment and systems, and fireplace hardware. There is also diverse manufacturing activity in some of the smaller communities. A manufacturer of ladies' undergarments recently expanded its branch plant in Oxford, and a firm in Sherburne manufactures television apparatus. Greene has recently experienced considerable industrial development. The largest manufacturer in that community produces materials-handling equipment. Over 5,400 persons work in manufacturing plants in the Chenango Valley Center, and this total has shown a steady gain in recent years.

Expansions from 1964 through 1967 represent an investment of over $2 million and have resulted in the utilization of about 425,000 square feet of manufacturing space.

A number of laboratories in the Chenango Valley Center conduct both basic and applied research in a variety of fields. One of the largest, in Norwich, employs over 300 scientists, technicians and supporting personnel engaged in research related to pharmaceuticals and cardiovascular diseases. Others, located in Sherburne and in Norwich, conduct research in many fields, including aerospace electrical systems and antenna systems.

Most of the hinterland area, as well as some land in the center, is devoted to agriculture. Milk production for the New York Metropolitan Area is the leading agricultural activity. Chenango County ranks eighth in New York State in sales of dairy products while nearby Delaware and Otsego Counties rank second and fifth.

Recreational facilities in the area include a ski center near Greene, a state-maintained game farm at Sherburne, and a fish hatchery at nearby South Otselic. More recreational development will be needed to meet future demands.

The Cohocton River Valley-Hammondsport Growth Center. The Cohocton River Valley-Hammondsport Growth Center extends along U.S. Route 15 and the Cohocton River from Wayland to Bath. It also includes the village of Hammondsport on the southern tip of Keuka Lake, eight miles northeast of Bath. U.S. Route 15 is at present the major north-south route through the growth center, connecting Rochester in the north, and Elmira in the south. Within this growth center would be the intersection of the Southern Tier Expressway (Corridor "T") and the proposed Genesee expressway which would be a limited access highway paralleling U.S. 15 to Rochester. Several State highways intersect U.S. Route 15 and provide fairly direct access to other nearby urban centers. Rail service is provided by the Erie-Lackawanna Railwoad and a small local line, the Bath and Hammondsport Railroad. There are two general aviation airports near Hammondsport and one near Bath. Scheduled air carrier service is available at the Chemung County Airport, about 30 miles southeast of Bath.

The population of the Cohocton River Valley-Hammondsport Growth Center is over 28,500. Between 1950 and 1960, it increased about eight percent. The largest gain, both in relative and absolute terms, occurred in the Village of Bath. Dansville, Wayland and Avoca had small population increases over the decade and Hammondsport had a small decline.

There is considerable manufacturing activity in the growth center. The largest employers are an electronic tube manufacturer in Bath and a power-plant manufacturer at Dansville. There are also a number of small and medium-sized plants in Bath. Hammondsport is the home of three of the leading New York State wineries, as well as a large manufacturer of bus bodies and sheet metal products. A large wood furniture plant is located in Wayland along with a wood products plant. Avoca and Cohocton each have small manufacturing plants. Although no precise data on manufacturing employment in the growth center are available, it is estimated at well over 4,200.

Since the beginning of 1964, there have been eight major manufacturing expansions in the growth center which have added over 200,000 square feet of manufacturing space and several hundred new jobs.

In summary, the major factors in this center's growth potential are its diversified industrial base and planned improvements in its highway transportation system. In addition, there are several existing and potential industrial sites in the growth center.

The Hornell-Alfred Growth Center. The horseshoe-shaped Hornell-Alfred Center is located in the upper valley of the Canisteo River. It includes the City of Hornell, the Villages of Canisteo and Alfred and the Towns of Hornellsville, Canisteo, Almond, and Alfred in Steuben and Allegheny Counties. Development is limited by topography and physical isolation.

No major east-west or north-south highways pass through the center. State Routes 21, 36, and 248 provide access to Route 17 and the planned Southern Tier Expressway. Route 70 provides access to U.S. Route 15. The State's Appalachian Development Highway Plan has been amended to reroute the Southern Tier Expressway to pass just north of Hornell and to connect, near Bath, with the planned Genesee Expressway.

The Erie-Lackawanna Railroad repair shops at Hornell have made it an important rail center; however, the changing economics of railroading have adversely affected Hornell's growth. There is a municipal airport just north of Hornell providing general aviation service. The nearest scheduled air carrier service is available at the Chemung County Airport, 50 miles southeast of Hornell, or the Olean Municipal Airport, 45 miles southwest of Alfred.

Approximately 25,000 people reside in the Hornell-Alfred Center. From 1950 to 1960, Hornell's population declined by about 1,100, but this loss was offset by gains in the surrounding Town of Hornellsville and the Village of Alfred. A census taken in 1965 revealed that the population of Alfred increased 20 percent over 1960.

Major firms in Hornell produce postal equipment, women's hosiery, synthetic textiles, electric transformers, and housings for bearings. There are small manufacturing plants in both Alfred and Canisteo. Manufacturing employment in the center is estimated at 1,350.

Alfred is the home of Alfred University, the State University of New York College of Ceramics and its Agricultural and Technical College. The approximately 4,600 students enrolled comprise a large proportion of the community's population. Both Alfred University and the State University Agricultural and Technical College are undertaking multi-million dollar expansion programs which are expected to result in enrollment increases. The College of Ceramics is doing extensive research in ceramics, high temperature materials, solid state physics, and chemistry.

Hornell is a trading center for a large part of western Steuben County. In 1963, retail sales there totaled nearly $25 million, up one percent from 1958.

Ithaca-Cortland Growth Center. The Center includes the cities of Ithaca and Cortland and parts of seven towns. The two cities are nuclei of manufacturing, commercial and educational activity. Between them are a number of "bedroom" communities and associated commercial developments. The primary service communities of Marathon and Whitney Point lie along Interstate Highway 81. The area north of Ithaca, on both sides of Cayuga Lake, is largely residential. Route 13 (a proposed development corridor in the State's Appalachian Development Highway Plan) from Cortland to Ithaca connects the center with Elmira to the southwest.

The center is served by the Erie-Lackawanna and the Lehigh Valley Railroads. Scheduled air carrier service is available at the Tompkins County Airport in the Town of Ithaca. There is another small airport in Ithaca and a new general aviation airport near Cortland.

The population of the Ithaca-Cortland Center exceeded 80,000 in 1960, about 11 percent higher than 1950. Census taken in 1965 showed continued population growth in suburban towns such as Cortlandville, Dryden, and Ithaca. The city of Ithaca experienced a small population decline between 1950 and 1960, and an additional two percent through 1965. The population of Marathon was little changed from 1950 to 1960, but that of Whitney Point rose by one-fifth over that period and by another six percent from 1960 to 1966. The hinterland includes all of Cortland and Tompkins Counties and small parts of adjacent counties.

Ithaca and Cortland are important manufacturing centers, although Ithaca is primarily noted as a center of higher education. There is also considerable manufacturing activity in the centers outside of these cities. Ithaca and Cortland, as well as Groton, have large plants manufacturing typewriters and business machines. Other major manufacturers in Ithaca produce automotive transmission equipment, small arms, sleepwear, and special tools and dies. Cortland firms produce forgings and stampings, wire products, marine hardware, foundation garments, motor trucks, vending machines, overhead doors, and boats. On the shore of Cayuga Lake, north of Ithaca, are two sizable producers of salt. There are also concentrations of small and medium-sized manufacturing plants just west of Cortland in McGraw and just north of Cortland in Homer. About 15,000 persons work in manufacturing plants in the center.

Manufacturing expansions costing many millions of dollars have been completed in the center in the past several years, are underway or are currently planned. These expansions provide about 450,000 square feet of new manufacturing space.

Marathon and Whitney Point have a variety of essential retail and service establishments. Marathon also has several small plants employing 150 persons. Products made there are aluminum boats, foundation garments, and skates. Whitney Point, at the foot of Otselic Lake, is primarily a residential and farming community. Both villages lie along Interstate Route 81, and good industrial sites are available.

Cornell University, at Ithaca, with an enrollment of over 14,000 in 1968, has a major influence on the local economy. The University provides many jobs; it is a major source of business for local merchants and provides consulting talent for businesses over a wide area.

The State University of New York Colleges of Agriculture, Veterinary Medicine, Home Economics, and Industrial and Labor Relations

at Ithaca has a combined enrollment of over 4,700 persons. Ithaca College has more than 3,500 students, and has a $30 million expansion and campus relocation project nearing completion.

The State University of New York College at Cortland has an enrollment of over 4,000 in 1968, and at the present time, the school is undertaking a $23 million expansion program to meet an anticipated enrollment increase by 1970. Expansion plans for the schools in Ithaca will cost well over $100 million.

Research conducted at institutions of higher education in the Ithaca-Cortland Center is complemented by several private industrial research laboratories. These do work in photocopying, business machines, fluid dynamics, materials mechanics, power transmissions, and torque devices. Space in the Cornell University Research Park is available to private firms.

The hinterland area provides abundant recreation opportunities for residents of the Ithaca-Cortland Center. Three state parks, all within 15 miles of Ithaca, attracted over 400,000 visitors in a recent year. There are several popular ski resorts in the hinterland, especially in Cortland County. There is also a multi-million dollar state park complex being developed along the shores of Cayuga Lake, consisting of recreational areas, a marina, and a municipally-owned performing arts center.

Susquehanna Valley Growth Center. This center runs along the valley of the Susquehanna River in Otsego and Delaware Counties and cuts across the southeastern corner of Chenango County. The three major urban areas are the City of Oneonta, the Village of Sidney, and the Village of Bainbridge. It also includes six towns in the three counties. The central city, Oneonta, lies almost equidistant from three large metropolitan area cities - Albany-Schenectady-Troy to the northeast, Binghamton to the southwest and Utica-Rome to the north. Two highways connect the center with these three metropolitan areas. Presently, Route 28 runs north to the Utica area, and Route 7 runs along the Susquehanna Valley from Binghamton, through Oneonta east to the capitol area. Interstate 88, paralleling Route 7, will provide the center with quick access to the Albany-Schenectady-Troy area and to the large metropolitan areas of New England. The Syracuse Metropolitan Area, although not on a direct route, is within easy driving distance. Rail service in the center is provided by the main line of the Delaware and Hudson Railroad, and a branch of the Penn-Central Railroad. There are general aviation airports at Oneonta and Cooperstown and a non-commercial airport at Sidney. A major expansion of the Oneonta Airport was completed in the fall of 1966. The contributory hinterland of this center includes most of Delaware and Otsego Counties, as well as part of adjacent Chenango County.

The population of the Susquehanna Valley Center was over 35,000 in 1960, an increase of more than eight percent over 1950. The greatest relative population growth during the decade occurred along the northern shore of the Susquehanna River, in the towns of Oneonta, Otsego, Unadilla, and Bainbridge. The number of residents in the City of Oneonta dipped 1.1 percent between 1950 and 1960; however, a census taken in 1966 showed a sizeable gain (8.3 percent) in the city's population since 1960.

Major products manufactured in the city of Oneonta include medical coaches and dental and X-ray trailers, electrical components, and dresses. A new operation will produce glass-ceramic wall cladding. The Village of Sidney attracts workers to an aircraft-components plant, a laminated wood products plant, and a manufacturer of desk calendars. There is considerable manufacturing activity in some of the smaller communities, while glues and plastics are major products manufactured in Bainbridge. In all, over 7,200 persons work in manufacturing plants in the Susquehanna Valley Center and this total has shown a steady growth in recent years.

In the past three years, a number of new manufacturing plants have been established in the Susquehanna Valley Center. Manufacturers have also expanded existing facilities. These represent an investment of over $1.6 million and have resulted in the utilization of over 150,000 square feet of manufacturing space. There have also been several industrial expansions in the hinterland area since the beginning of 1964.

Five villages are primary service communities in the hinterlands of the center. Three to the south, Delhi, Stamford, and Walton, are connected with each other, and with Oneonta, by State Routes 28 and 10. The others, Cooperstown and Richfield Springs, are north of the growth center and lie along State Highway 28 which is a north-south route through Oneonta.

Cooperstown, the county seat of Otsego County, is principally a marketing and recreational center. Walton, on the southerly edge of the area, has a number of small manufacturing plants, which employ a total of more than 600 persons. Cheeses, automotive accessories, wood furniture, and other lumber products are the major lined in Walton. The Village also is a small marketing center for the western portion of Delaware County. Stamford has about a half dozen factories, which together employ almost 300 persons. Products made include charcoal, electronic equipment, and wood furniture. Richfield Springs and Delhi have small manufacturing plants. Good industrial sites are found in or near each of these communities.

A vital factor in the recent growth of the Susquehanna Valley Center has been the expansion of institutions of higher education. The State University of New York College at Oneonta has an enrollment

of more than 4,400 in 1968 as a result of a multi-million dollar expansion program. Hartwick College in Oneonta is also in the process of expanding. Enrollment there in 1968 was over 1,500, almost double the total in 1960. A third institution of higher education - the State University of New York Agricultural and Technical College at Delhi - is located in the hinterland area and registration there has more than doubled in recent years.

A large laborarory in Sidney is engaged in research related to aircraft, rocket and missile components and systems. Other laboratories in Bainbridge conduct biological studies and research in caseins and resin adhexives.

The hinterland area includes many recreational facilities which attract tourists from all over the northeastern United States. A large section of eastern Delaware County is in the Catskill State Park.

Most of the hinterland area, as well as some land in the center, is devoted to agriculture and marketing milk to the New York area. Delaware County is a leader in New York State in sales of dairy products, second only to St. Lawrence County, while Otsego and nearby Chenango Counties rank fifth and eighth. Poultry production is also of great importance, especially in Otsego County.

Cobleskill-Schoharie Growth Center. The Cobleskill-Schoharie Growth Center is composed of the towns of Cobleskill, Schoharie, Richmondville and Middleburgh in Schoharie County. The four communities had a total 1960 population in excess of 12,000 persons. This was a 4.5 percent gain over the 1950 population. The growth center has an expanding state university and serves as a trade and recreation center. Scotch Valley Ski Resort is one of the better known recreation facilities in the area. With the building of Interstate 88, the center will have good potential for future growth. It is located near the State Capital of Albany. It has good recreation areas, suitable industrial sites, and an active economic development organization.

Tables 3-7 and 3-8 give employment by major categories for State Planning Sub-region 1 and State Planning Sub-region 2, and Tables 3-9 and 3-10 show the socio-economic characteristics of these sub-regions.

TABLE 3-7
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
NEW YORK STATE PLANNING SUB-REGION 1*/

	1950	1960	Absolute Change
TOTAL ALL SECTORS	71,001	75,973	4,972
PRIMARY ACTIVITIES	6,914	4,265	- 2,649
Agriculture	6,829	4,210	- 2,619
Forestry & Fisheries	35	27	- 8
Mining	50	28	- 22
SECONDARY ACTIVITIES	28,861	32,602	3,741
Contract Construction	3,639	3,722	83
Food & Kindred Products	1,428	1,848	420
Textile Mill Products	918	491	- 427
Apparel	296	263	- 33
Lumber, Wood Products, Furniture	866	976	110
Printing & Publishing	1,450	1,566	116
Chemicals & Allied Products	369	379	10
Electrical & Other Machinery	7,940	10,264	2,324
Motor Vehicles & Equipment	1,705	2,126	421
Other Transportation Equipt.	156	382	226
Other & Miscellaneous	10,094	10,640	546
TERTIARY ACTIVITIES	34,237	36,523	2,286
Transportation & Communications	5,848	4,364	- 1,484
Utilities & Sanitary Service	760	831	71
Wholesale Trade	1,991	1,760	- 231
Retail Trade	10,399	10,215	- 184
Finance, Ins. & Real Estate	1,409	1,767	358
Personal Services	4,982	5,323	341
Professional Services	5,954	9,215	3,261
Recreational Services	400	386	- 14
Public Administration	2,436	2,609	173
Armed Forces	58	53	- 5
NOT REPORTED	989	2,583	1,594

*/ This information is for Steuben, Schuyler, and Chemung Counties, the portion of State Planning Sub-region 1 located in Water Sub-region B.

TABLE 3-8
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
NEW YORK STATE PLANNING SUB-REGION 2

	1950	1960	Absolute Change
TOTAL ALL SECTORS	172,639	190,189	17,550
PRIMARY ACTIVITIES	22,874	15,587	- 7,287
Agriculture	22,448	15,042	- 7,406
Forestry & Fisheries	704	67	- 37
Mining	322	478	156
SECONDARY ACTIVITIES	65,595	76,011	10,416
Contract Construction	9,440	9,793	353
Food & Kindred Products	4,118	3,920	- 198
Textile Mill Products	2,068	1,054	- 1,014
Apparel	2,299	2,006	293
Lumber, Wood Products, Furniture	2,840	2,380	- 460
Printing & Publishing	2,226	3,288	1,062
Chemicals & Allied Products	983	1,681	698
Electrical & Other Machinery	14,521	23,543	9,022
Motor Vehicles & Equipment	598	702	104
Other Transportation Equipt.	1,054	2,812	1,758
Other & Miscellaneous	25,448	24,832	- 616
TERTIARY ACTIVITIES	81,855	92,187	10,332
Transportation & Communications	8,862	6,734	- 2,128
Utilities & Sanitary Service	2,059	2,150	91
Wholesale Trade	4,529	3,845	- 684
Retail Trade	24,438	25,090	652
Finance, Ins. & Real Estate	3,696	4,996	1,300
Personal Services	12,574	13,187	613
Professional Services	19,690	29,463	9,773
Recreational Services	1,173	932	- 241
Public Administration	4,627	5,595	968
Armed Forces	207	195	- 12
NOT REPORTED	2,315	6,404	4,089

TABLE 3-9
SOCIO-ECONOMIC CHARACTERISTICS
NEW YORK STATE PLANNING SUB-REGION 1 */
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1966	
Total	217,700
Absolute Change 1960-1966	6,300
Percent Change 1960-1966	2.98

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	211,441	104,136	107,305	15,234	77,065	119,142
Percent Distribution	100.00	49.25	50.75	7.20	36.45	56.35
Percent Change 1950-1960	9.87	8.01	11.74	- 47.79	34.55	12.41

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Total	Under $2,000	$2,000-$2,999	$3,000-$5,999	$6,000-$9,999	$10,000 & Over
Number	52,410	5,019	3,677	20,236	17,514	5,964
Percent Distribution	100.00	9.58	7.02	38.61	33.42	11.38
Percent Change 1950-1960	7.86	-56.66	-64.93	3.19	397.56	659.74

EDUCATION OF PERSONS 25 AND OVER, 1960

	Total*	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	118,352	40,558	21,822	18,736
Percent Distribution	100.00	34.27	18.44	15.83
Percent Change 1950-1960	3.69	- 8.14	- 5.61	- 10.91

*Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	75,920	4,360	50,610	2,664	25,310	1,696
Percent Distribution	94.57	5.43	95.00	5.00	93.72	6.28
Percent Change 1950-1960	7.01	17.17	- 0.84	- 2.60	27.16	72.01

RATE OF UNEMPLOYMENT, 1962-65

1962	5.9
1963	4.8
1964	4.2
1965	3.9

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force *	Out of Labor Force	In Labor Force *	Out of Labor Force	In Labor Force *	Out of Labor Force
Number	80,333	67,574	55.323	18,615	27,010	48,959
Percent Distribution	54.31	45.69	74.12	25.88	35.55	64.45
Percent Change 1950-1960	7.51	- 2.10	- 0.93	5.69	29.26	- 4.77

*Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	87.8	1.9	2.2
Tot. Employment	84.4	3.6	4.5
Unemployment	3.4	- 1.7	- 33.3

*/ This information is for Steuben, Schuyler and Chemung Counties, the portion of State Planning Sub-region 1 located in Water Sub-region B. Unless otherwise noted, all other references to State Planning Sub-region 1 are for a six-county area (See Appendix E for boundary).

TABLE 3-10
SOCIO-ECONOMIC CHARACTERISTICS
NEW YORK STATE PLANNING SUB-REGION 2
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1966		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	548,100	Number	519,081	255,446	263,635	51,423	206,137	261,521
Absolute Change 1960-1966	29,000	Percent Distribution	100.00	49.21	50.79	9.91	39.71	50.38
Percent Change 1960-1966	5.58	Percent Change 1950-1960	10.87	10.12	11.62	-40.54	48.78	7.57

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	12,015	9,717	46,156	43,404	17,679	128,971
Percent Distribution	9.32	7.53	35.79	33.65	13.71	100.00
Percent Change 1950-1960	-57.86	-59.50	-2.23	343.58	529.15	9.33

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	289,268	97,994	137,231	50,307
Percent Distribution	100.00	33.88	47.44	17.39
Percent Change 1950-1960	4.54	-11.01	18.41	29.67

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	197,667	9,524	130,616	6,230	67,051	3,294
Percent Distribution	95.40	4.60	95.45	4.55	95.32	4.68
Percent Change 1950-1960	9.20	18.27	2.74	7.53	24.42	45.82

RATE OF UNEMPLOYMENT, 1962-65

1962	5.2
1963	5.6
1964	5.1
1965	4.3

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	207,390	164,394	137,037	42,710	70,353	120,784
Percent Distribution	55.78	44.22	76.24	23.76	36.81	63.19
Percent Change 1950-1960	9.56	6.19	2.95	5.33	25.25	5.70

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng.1962-65 No.	Chng.1962-65 %
Tot.Work Force	212.3	-3.2	- 1.49
Tot.Employment	203.2	-1.0	- 0.49
Unemployment	9.1	-2.2	-19.47

State Planning Sub-region 9

State Planning Sub-region 9 is composed of Bradford, Sullivan, Susquehanna, Tioga, and Wyoming Counties in Pennsylvania. The sub-region is sparsely settled and is devoted largely to dairy farming. The northern Pennsylvania counties are influenced by employment and shopping opportunities in the growing New York State urban areas of Elmira and Binghamton.

In 1965, the population of State Planning Sub-region 9 was about 148,000; the civilian labor force was about 43,000 and total employment was about 39,000. During the period 1960-1965, there was a minor decline in total population (-0.1 percent); however, both the total civilian labor force and the number employed decreased about 22 percent.

Heavy declines in employment occurred during the period 1960-1965 in all manufacturing groups except chemicals and petroleum, which increased 25.0 percent. Food and textiles; wood and paper; clay, glass, and metals each declined about 31 percent, while machinery and miscellaneous declined about 25 percent. Employment in construction underwent a major reduction of about 57 percent during the period.

Within the non-manufacturing sector, increases in employment during the period 1960-1965 were mining (a 100 percent increase); Government (12.8 percent); and other private services (25 percent). Declines were experienced by transportation and utilities (-37.9 percent) and wholesale and retail trade (-30.6 percent); and agriculture, forestry and fisheries (-28.9 percent).

In 1965, there were 2,700 persons unemployed in State Planning Sub-region 9. This was 18.2 percent less than in 1960. The unemployment rate in 1965 was 4.8 percent.

Most of the manufacturing jobs in these Pennsylvania counties are located in the communities of Sayre-Athens, Towanda, and Wellsboro (each with a population of less than 10,000). The chief manufactured products include leather goods, electrical machinery, apparel, and primary metals. Tourism is significant in the economy of these counties. The area appears to have excellent potential for recreation developments. There are a number of locations, particularly along the Susquehanna River, where the potential for diversified manufacturing development is good. A number of new wood-using enterprises have located in the area.

Major highway corridors within State Planning Sub-region 9 include Corridor U which runs from Elmira, New York to Williamsport, Pennsylvania, where it connects with Corridor P. Corridor P loops the area connecting to Interstate 80 at Lock Haven and Williamsport.

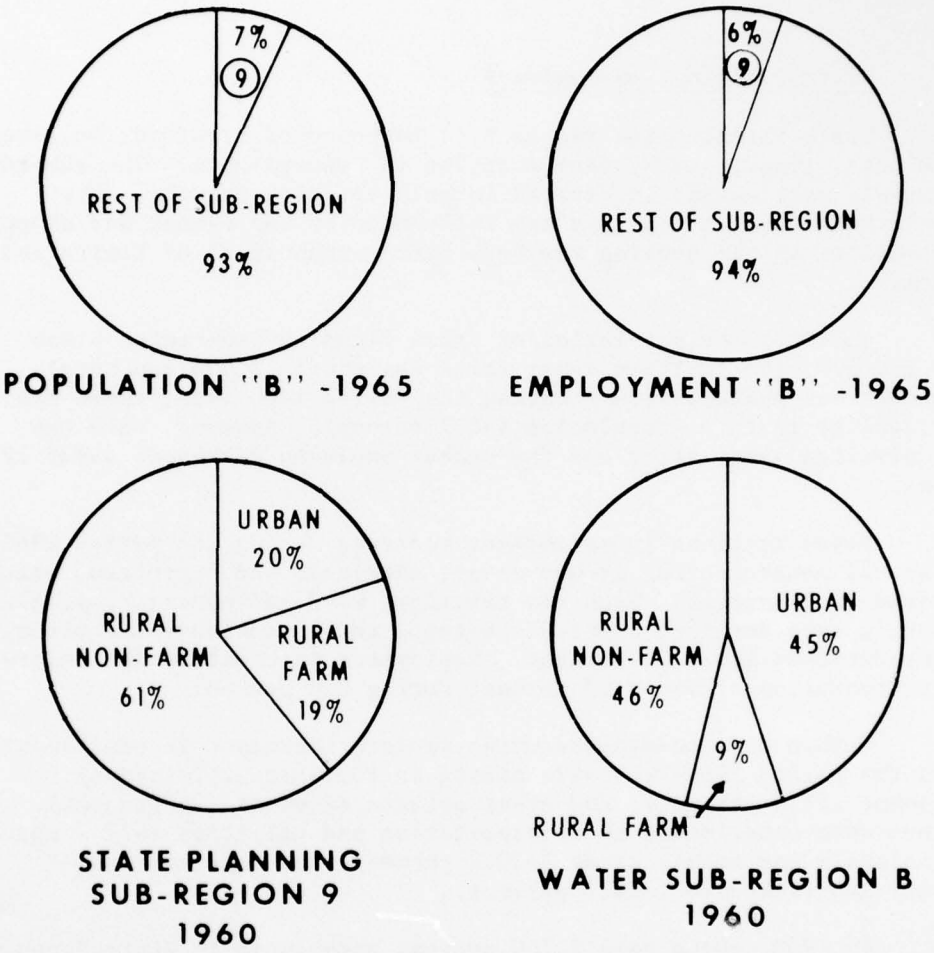


Figure 3-22 - Population, Employment, and Urban-Rural Population Distribution of State Planning Sub-region 9 Compared to Water Sub-region B.

Growth centers located within State Planning Sub-region 9 include parts of the Binghamton-Owego-Susquehanna County Growth Center and the Chemung River Valley Growth Center. Both of these growth centers have been discussed previously under New York State Planning Sub-regions 1 and 2.

Employment by major categories and socio-economic characteristics of Pennsylvania State Planning Sub-region 9 are shown in Tables 3-11 and 3-12.

AD-A041 387 CORPS OF ENGINEERS CINCINNATI OHIO F/G 8/6
DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. MAIN REPORT. PART--ETC(U)
NOV 69

UNCLASSIFIED NL

4 OF 7
AD
A041387

TABLE 3-11
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
PENNSYLVANIA STATE PLANNING SUB-REGION 9

	1950	1960	Absolute Change
TOTAL ALL SECTORS	48,577	50,511	1,934
PRIMARY ACTIVITIES	13,420	9,087	- 4,333
Agriculture	12,632	8,550	- 4,082
Forestry & Fisheries	49	39	- 10
Mining	739	498	- 241
SECONDARY ACTIVITIES	15,106	19,575	4,469
Contract Construction	2,995	2,889	- 106
Food & Kindred Products	986	1,371	385
Textile Mill Products	638	300	- 338
Apparel	1,499	1,386	- 113
Lumber, Wood Products, Furniture	1,384	1,105	- 279
Printing & Publishing	383	569	186
Chemicals & Allied Products	91	124	33
Electrical & Other Machinery	2,297	4,969	2,672
Motor Vehicles & Equipment	122	259	137
Other Transportation Equipt.	25	276	251
Other & Miscellaneous	4,686	6,327	1,641
TERTIARY ACTIVITIES	19,305	20,518	1,213
Transportation & Communications	3,640	2,481	- 1,159
Utilities & Sanitary Service	578	659	81
Wholesale Trade	719	671	- 48
Retail Trade	5,513	6,032	519
Finance, Ins. & Real Estate	681	895	214
Personal Services	3,271	3,012	- 259
Professional Services	3,570	5,272	1,702
Recreational Services	144	157	13
Public Administration	1,150	1,232	82
Armed Forces	39	107	68
NOT REPORTED	746	1,331	585

TABLE 3-12
SOCIO-ECONOMIC CHARACTERISTICS
PENNSYLVANIA STATE PLANNING SUB-REGION 9
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	146,000
Absolute Change 1960-1965	-1,700
Percent Change 1960-1965	-1.15

POPULATION 1960						
	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	147,740	73,395	74,345	28,242	90,484	29,014
Percent Distribution	100.00	49.68	50.32	19.12	61.25	19.63
Percent Change 1950-1960	37.83	37.22	38.45	-7.65	89.56	0.48

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	5,124	4,109	15,659	8,895	2,992	36,779
Percent Distribution	13.93	11.17	42.58	24.18	8.14	100.00
Percent Change 1950-1960	-49.17	-37.55	88.78	650.63	849.84	33.94

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years *Elementary School*	1-4 Years *High School*	1 or More Yrs. *of College*
Number	80,431	29,557	41,008	8,922
Percent Distribution	100.00	36.75	50.99	11.09
Percent Change 1950-1960	33.47	14.19	55.72	43.21

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	50,404	2,975	35,609	2,083	14,795	892
Percent Distribution	94.43	5.57	94.47	5.53	94.31	5.69
Percent Change 1950-1960	37.38	39.02	28.13	18.02	66.27	137.87

RATE OF UNEMPLOYMENT, 1962-65

1962	8.8
1963	6.9
1964	5.9
1965	4.8

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	53,486	49,369	37,799	12,473	15,687	36,896
Percent Distribution	52.00	48.00	75.19	24.81	29.83	70.17
Percent Change 1950-1960	37.66	24.29	27.79	34.44	69.11	21.20

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	56.7	-1.3	- 2.3
Tot. Employment	54.0	1.1	2.1
Unemployment	2.7	-2.4	-47.1

Water Area B-2

Water Area B-2 contains Pennsylvania State Planning Sub-region 8 and 7.

State Planning Sub-region 8

Pennsylvania State Planning Sub-region 8 is composed of the following eleven counties: Centre, Clinton, Lycoming, Columbia, Montour, Northumberland, Union, Snyder, Mifflin, Juniata, and Perry.

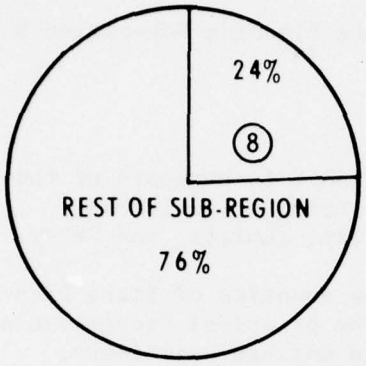
Economic and social interests in the counties of State Planning Sub-region 8 tend to gravitate toward the principal Pennsylvania urban areas of Williamsport-Lock Haven, State College-Bellefonte, Sunbury-Shamokin-Mt. Carmel, Berwick-Bloomsburg, and Lewiston. These urban areas account for most of the persons residing within this sub-region.

The early lumber industry in the upper reaches of the Susquehanna River exerted a strong influence on the development patterns. There is a string of valley communities extending from Lock Haven in the north, south to Amity Hall at the confluence of the Susquehanna and Juniata Rivers.

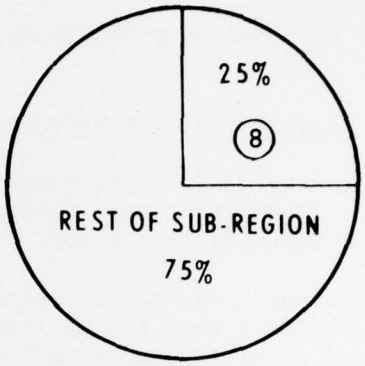
The economic base of this sub-region is highly diversified. Major industries include apparel, textiles, aircraft and parts, primary and fabricated metals, paper and printing, lumber and wood products, education and research, agriculture and mining. Williamsport and Lock Haven are the chief centers for aircraft and related industries, whereas one of Pennsylvania's leading educational and research centers is found in State College. Textile, apparel, and mining industries dominate in the Sunbury, Shamokin, Berwick and Bloomsburg areas, while farming enterprises have tended to concentrate in the fertile Susquehanna, Kishacoquillas, and Nittany Valleys.

For some time most sections of the northern portion of the water areas have been showing little, if any, growth in overall population and income. Key local industries such as mining and railroads have declined. An important aspect to future development in these counties are the Appalachian development highways and Interstate 80 which will substantially improve east and west access.

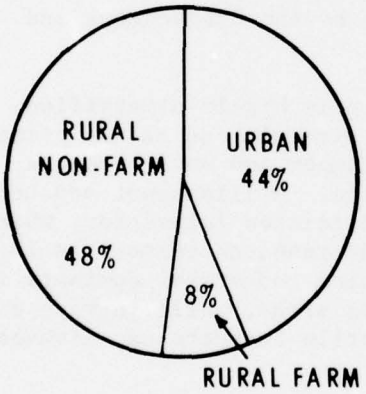
In 1965, the counties of State Planning Sub-region 8 had a total population of about 559,000 people. Out of a total civilian labor force of about 210,000 in 1965, about 199,000 were employed. During the period 1960-1965, population increased 3.8 percent and total employment increased about 2.2 percent. The increase in manufacturing employment during this period was about double that of the Service sector.



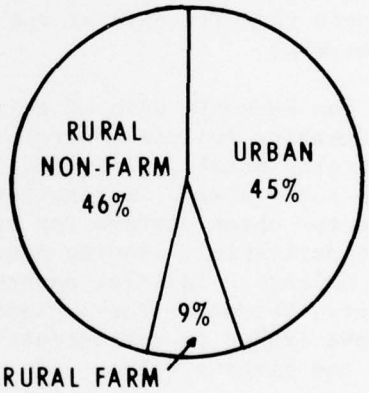
POPULATION "B" -1965



EMPLOYMENT "B"'-1965



STATE PLANNING
SUB-REGION 8
1960



WATER SUB-REGION B
1960

Figure 3-23 - Population, Employment, and Urban-Rural Population Distribution of State Planning Sub-region 8 Compared to Water Sub-region B.

All manufacturing sectors experienced employment increases of 10 to 12 percent during the period 1960-1965. Employment in the construction industry, however, decreased about 22 percent.

Most non-manufacturing industries experienced declines during this period. Employment losses were heaviest in mining (-53.7 percent), transportation and utilities (-22.7 percent) and agriculture, forestry and fisheries (-19.7 percent). Relatively smaller losses were experienced in wholesale and retail trade (-11.2 percent). The two employment categories showing gains were government (12.9 percent) and other private services (30.5 percent). These categories have shown similar increases in most of the Water Sub-region during this period.

The civilian labor force in State Planning Sub-region 8 included about 210,000 persons in 1965; about 4.4 percent of these were unemployed. The number of unemployed persons in State Planning Subregion 8 declined about 27 percent during the period 1960-1965.

State College (Centre County). The total civilian labor force for Centre County numbered 34,100 in April of 1967. Unemployed persons totaled 2.3 percent of the labor force. Farm employment was estimated at 1,100 persons.

All types of labor are in great demand and there has been a net inmigration over the last several years. This has been due primarily to the presence of Pennsylvania State University. A new vocational-technical school was completed in the fall of 1968. Local officials believe that the educational system is adequate to meet the demands of industry for qualified labor.

The State College area has several manpower training programs which operate in conjunction with the University. The Bellefonte area, on the other hand, does not have any manpower training programs. Neither area has any "quick-start" programs. There is good cooperation among guidance counselors, development groups, and industry in making job opportunities known. The labor market information machinery is widely used by the populace.

Poor transportation facilities have hindered the development of Centre County. To go east, a traveler must take State Route 45 for 75 miles to Milton to gain access to the completed portion of Interstate 80 or use U.S. Route 322 to the connecting routes in Harrisburg. To go west, one must take U.S. Route 322 to U.S. Route 220 and proceed to U.S. Route 22. Interstate 80 will pass north of Bellefonte and there are plans to provide a local access road to it from State College. Southern links will be provided by the widening and relocation of U.S. Route 322 which will connect with the Appalachian Corridor M through Altoona, Lewistown, and Harrisburg. Northeast and southwest access will be greatly improved by the widening of U.S. Route 220 which has been designated as Appalachian Corridor O.

The Bellefonte area problems will be partially alleviated with the completion of Interstate 80, U.S. Route 220, and U.S. Route 322. County officials regard the future accessibility of the area as one of its greatest assets. Motor freight carrier service is good and will improve due to the new highway system.

The Bellefonte Central and Penn-Central Railroads provide service to all the major industries in the area.

Allegheny Airlines maintains daily flights into Mid-State Airport near Philipsburg. Future development plans must include improved access to the airport.

The State College area is oriented toward research and development industries. Potential industrial land is available in the townships surrounding the Borough of State College.

The economy of the Bellefonte area is primarily dependent upon manufacturing industries. The labor force is adequately diversified to serve almost any type of industry that might want to locate in the region. There are no industrial parks in the Bellefonte area and the industrial development corporation does not hold any land for future industrial sites. With the completion of Interstate 80, the Appalachian Thruway, and the Foster Joseph Sayers Reservoir, the area will have many highly desirable industrial sites.

The Borough State College is served by its own municipal water authority, serving approximately 26,000 people. Mountain streams and wells are the sources of the present supply. Water quality is good and water is abundant in the area, but problems arise where storage and distribution are concerned. These problems must be solved if the area is to continue to develop and grow. Independent water authorities serve the remainder of the area. Overall gas and electric service to the area is good.

The attitude of bankers in the State College area toward industrial lending is very conservative and selective. The relative absence of financial assistance or tax relief to manufacturing industry reflects the general attitude of the community. State College is a very sophisticated community which wants to preserve its college town atmosphere. State College has never had employment problems and since the present labor market is tight, the area can afford to be selective.

There is some mining in the northern tier of the county with its associated mine restoration problems. There are isolated instances of air pollution due primarily to the manufacturing of agricultural lime. County officials, however, do not see these problems as hindering the development of the area.

Centre County has excellent recreational facilities. Among the county's parks are Black Moshannon State Park, Stone Valley Park, Whipple Dam State Park, and the proposed State Park at the Foster Joseph Sayers Reservoir.

The county has an abundance of good quality water. The problems arise from inadequate storage and distribution facilities. Spring Creek in the State College-Bellefonte area is subject to organic and nutrient pollution. Tertiary waste treatment is needed. In the Philipsburg area, Moshannon Creek is very acidic from mine drainage. There is also some mine drainage on small streams in western and northern portions of the county.

Lock Haven (Clinton County). The total work force of Clinton County was estimated at 15,200 in February of 1967. Unemployment was 5.9 percent of the labor force. Farm employment totaled 500. Employment in manufacturing industries numbered 6,700 persons.

Access to the Lock Haven area is somewhat restricted. East-west access will be substantially improved with the completion of the Interstate 80 and the widening of U.S. Route 220. Interstate 80 will pass below Lock Haven through the Boroughs of Mackeyville, Clintondale, and Lamar. North-south access is very restricted; however, Pennsylvania Route 120 is scheduled for improvement. This will improve connections to the north, but the area will still suffer from lack of an adequate transportation link to the south.

Lock Haven is adequately serviced by the Penn-Central Railroad and six trucking companies. Local officials foresee no impediments to development resulting from inadequate rail or truck service.

Air passengers must either travel to Williamsport or Harrisburg. However, the local airport is capable of handling executive aircraft and it is being enlarged to handle small jets. Land is available for additional expansion.

Presently, there are no industrial parks in the Lock Haven area; however, there is ample acreage for potential industrial developments. The prime areas are located along the route of Interstate 80 between Pennsylvania Routes 64 and 477. There are no local action groups promoting or developing the area, and necessary utilities are lacking.

Lock Haven and the townships to the south are served by many independent water authorities. The main sources of water for the area are excellent quality mountain streams. The Susquehanna is a potential source of water; however, treatment would be required since this river is subject to acid mine drainage pollution. The water supply is presently adequate.

The existing sewerage system is being used to capacity. The primary waste treatment facilities are adequate, but a new treatment plant will be needed if the area along the scheduled route of Interstate 80 is to be developed. Hammermill Paper Company will treat its waste products which enter Bald Eagle Creek.

The Clinton County area has excellent recreational facilities. There are numerous state parks and game lands in and around the region, including Bucktail State Park and the Sproul State Forest.

Sunbury-Milton (Columbia, Montour, Northumberland, Snyder and Union Counties). The total civilian labor force for Columbia, Montour, Northumberland, Snyder, and Union Counties numbered 89,700 in February of 1967. Unemployed persons were 4.8 percent of the labor force. Agricultural employment was estimated at 4,400. Manufacturing industries employed 34,400.

The five-county area suffered a net out-migration of 25,640 persons between 1950 and 1960. This trend has slowed in recent years and local officials expect it to be reversed in the near future.

The five counties comprise an area of 1,097,000 acres of which farmland constitutes 58 percent. Average farm size varies from 111 acres in Columbia County to 124 acres in Montour County. Farm income is derived primarily from dairy and poultry products.

The school system varies from good to poor. The quality of education is higher in the more densely settled areas. Considerable consolidation is required to improve the rural schooling. The median number of school years completed ranges from 8.9 in Snyder County to 10.3 in Columbia County.

Many workers commute to Sunbury and the areas to its north and south. Skill diversification is limited and industries must train new workers. Since there is a surplus of labor, skilled and semiskilled workers have been migrating to other areas to find work.

Six four-year colleges serve the area: Susquehanna University, Selinsgrove; Bucknell University, Lewisburg; Lycoming College, Williamsport; Lock Haven State College, Lock Haven; Pennsylvania State University, State College; and Bloomsburg State College, Bloomsburg.

Access to the Sunbury area is now in the process of being improved. East-west and north-south access will be improved with the completion of Interstate 80 and 81, respectively. U.S. Routes 11, 15, and 522 are scheduled for improvements.

The area is serviced by six motor freight carriers. Freight service is considered adequate and will expand as demand grows. Adequate rail service is provided by the Penn-Central, Reading, and Erie-Lackawanna Railroads.

The five-county area does not have a commercial airport although there are several small airports in the area. Allegheny Airlines maintains scheduled flights from Williamsport Airport, 40 miles north of Sunbury. After improvements to the Sun-Air Airport in Selinsgrove have been completed, the facility will be capable of accommodating small commercial jet aircraft.

The Lewisburg Chamber of Commerce owns a small parcel of prime industrial land in East Buffalo Township of Union County where all utilities are in place. The Sunbury Chamber of Commerce, in conjunction with the Penn-Central Railroad, has developed an industrial park of 400 acres in Northumberland County with all utilities in place.

The primary water sources for the region are mountain streams and wells. The Susquehanna River is used on occasion to supplement these sources. The area is serviced by many independent municipal and private water companies. Rural areas rely mainly on wells. Water quality ranges from excellent to poor depending upon the source used. Organic pollution and acid mine drainage limit sources of good quality water. Water supplies will need to be developed to support any significant industrial expansion. Consolidation of existing water authorities would be a step in the solution of the area's problems.

Only the more densely populated areas are sewered. The more important urban areas have their own primary treatment facilities but in most cases, these facilities are being used to capacity. Secondary or even tertiary treatment or flow augmentation will be needed to handle increased waste loads. Septic tanks are used extensively in rural areas.

Sunbury has been very active in seeking new industry. High unemployment in Northumberland County has made local officials realize the need to be competitive with other areas.

The Sunbury area has a 100 percent financing plan. The attitude of bankers toward industrial and residential financing is excellent. The community will also furnish aid in manpower training programs. In addition, extension of utilities and community services to chosen industrial sites is provided. Nevertheless, the industrial park located in Northumberland is in need of local access roads.

There are a variety of recreational facilities within the five-county region. Four parks are located in the Sunbury-Northumberland area. These parks have swimming, boating, picnicking, dancing and other recreation facilities. Additional recreation facilities should be developed to meet the demand that will arise from the industrial growth anticipated for the area. The best opportunities for developing recreational enterprises are located to the north of the Sunbury-Northumberland area. Montour Ridge and especially the adjacent northern slopes provide opportunities for the development of campgrounds, picnic areas, scenic attractions, and winter sports areas.

The Shamokin-Mt. Carmel section has been extensively strip mined. Huge culm banks and other mine wastes cover the landscape. These areas need to be backfilled and reforested. Shamokin, Zerbe Run, and the Mahanoy Creeks are seriously polluted from mine acid. These streams usually run black from coal deposits and are extremely high in sulfur content. Other streams south of Sunbury are polluted to a lesser extent. The West and the Main Stem of the Susquehanna River are polluted from mine drainage and organic discharges. This fact has led to the rejection of the rivers as a source of supply except in emergency situations.

To insure orderly development and growth, the five-county region should establish land use or zoning regulations. The use of such regulations is one means of obtaining a planned development which will benefit the maximum number of citizens. Prime industrial land and the best agricultural land, as well as residential land, should be preserved and protected for proper future use.

Lewistown (Mifflin County). Total civilian labor force in Mifflin and Juniata Counties was estimated at 24,400 in February of 1967. Unemployed numbered 900, 3.7 percent of the work force. Farm employment totaled 1,600 persons. Manufacturing industries employed 9,400.

The skill mixture of the labor supply is fairly diversified; however, information concerning job opportunities is not well distributed.

Industries in the area train their own labor force. The vocational-technical school just completed should play an important part in providing a trained labor force.

The Penn-Central Railroad and two locally based motor freight carriers service the Lewistown area. Service has been good and is

believed adequate to meet the area's industrial demands. Access to the Lewistown area has been a deterrent to industrial growth. The area can be reached from the north and south via U.S. Routes 522 and 22. East-west access is provided by U.S. Routes 322 and 22. These roads are narrow, winding, and difficult for heavy truck traffic; however, they are scheduled for improvement. U.S. Route 22 from Harrisburg to Altoona via Lewistown has been designated as Appalachian Corridor M. Scheduled improvements for U.S. Route 322 north to the State College-Bellefonte area will provide easy access to Interstate 80. U.S. Route 522 north-east to the Selinsgrove area also needs improvement.

Scheduled flights require driving either to Mid-State Airport in Centre County or to the airport in Harrisburg; however, Lewistown does have the Mifflin County Airport for small planes.

Lewistown has an industrial park of 120 acres of which 97 are still available. The park was developed and is presently owned by the Mifflin County Industrial Development Corporation. Additional land for industrial use is available. All utilities are in place and can be extended to the surrounding area.

The area is provided water by the Municipal Water Authority of the Borough of Lewistown. The Juniata River, is a potential source of water. Local officials believe that the quantity and quality of the area's water supply is more than adequate and will continue to be so due to a new upland impoundment. Sewerage systems and primary treatment are adequate at present, but will need expansion in the near future.

The attitude of local bankers toward industrial financing is very favorable. The Mifflin County Industrial Development Corporation provides the first 10 percent; the Pennsylvania Industrial Development Authority the next 40 percent; and local banks the final 50 percent. Tax relief has been given in the past and will continue to be provided. The community is willing to provide facilities and local access roads to sites chosen by new industry.

Environmental problems are minor. There is no mining in Mifflin County. There are isolated cases of non serious air pollution. The Juniata River is affected by residual organic pollution from Blair County. Therefore, Lewistown rejected the Juniata River as a water supply source in favor of an upland impoundment.

The Mifflin County area has an abundance of recreational facilities. Completion of the new Raystown Dam will bring boating facilities within easy driving distance of the Lewistown area.

Williamsport (Lycoming County). Total estimated employment for June of 1967 was 47,800. The unemployment rate of 4.0 percent was equal to the national average. Farm employment was estimated at 1,600. Employment in manufacturing industries totaled 20,200.

Six colleges or universities are within commuting distance of the Greater Williamsport Area: the Williamsport Area Community College, Lycoming College, Bucknell University, Susquehanna University, and Bloomsburg and Lock Haven State Colleges. Pennsylvania State University is located 62 miles from Williamsport. Local officials feel that the educational system is more than adequate to meet the demands by industry for most types of labor. There is good cooperation among guidance counselors, industry, and local development groups in the placing of workers.

Williamsport is served by two major railroads - the Penn-Central and the Reading Company and twenty motor freight carriers. With the completion of Interstate 80 and the scheduled improvements for U.S. Route 15 and 220, Williamsport will be easily accessible from every direction.

The Williamsport-Lycoming County Airport serves the area. Allegheny Airlines is the only scheduled airline. Facilities to handle shorthaul freight jet aircraft are being considered; however, the airport is subject to frequent closing due to climatic conditions.

Williamsport has a 300-acre industrial park located within the city limits that is almost entirely occupied. There are many good industrial sites, both east and west of Williamsport especially along the Susquehanna River between Muncy and Montgomery. Many of these sites have facilities, or the facilities are capable of being extended. Much of this land however, is susceptible to flooding by the Susquehanna. The Pennsylvania Power and Light Company has been taking an active role in the development of industrial acreage and is presently building two new power plants to service the area.

The Williamsport area is serviced by the Williamsport Municipal Water Authority. Mountain streams and a series of eight wells can provide 11 million gallons daily. Average daily consumption is 7.8 million gallons. There are many additional untapped mountain streams which are potential sources of water. The quality of the water sources is good. The West Branch of the Susquehanna River is a potential source for industrial water, but this supply is subject to periodic quality deterioration by mine acid drainage. The major effect is on recreational uses of the river. Local officials see no constraints on industrial development due to this water quality problem.

Sewerage facilities are presently adequate for the City of Williamsport; however, some of the areas surrounding the city proper do not have any sewer facilities. The State of Pennsylvania is presently directing communities along the Susquehanna to install secondary treatment works. While Williamsport itself has no serious water quantity problems, it is a major contributor to the problems of the communities lying below it on the Susquehanna River.

Local development groups are active in Williamsport trying to locate new industry. The number of new industries which have located in the area attest to their willingness to provide facilities and help develop sites.

Lycoming County has no mine restoration problem and air pollution is very minor. Excellent recreational spots are located within easy driving distance of Williamsport. Hunting and fishing cannot be equaled in any other county in Water Area B-2; however, there are no large lakes with recreational possibilities. Streams and rivers are plentiful.

Employment by major categories and socio-economic characteristics of Pennsylvania State Planning Sub-region 8 are shown in Tables 3-13 and 3-14.

TABLE 3-13
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
PENNSYLVANIA STATE PLANNING SUB-REGION 8

	1950	1960	Absolute Change
TOTAL ALL SECTORS	184,341	192,671	8,330
PRIMARY ACTIVITIES	27,534	15,640	-11,894
Agriculture	17,785	11,927	- 5,858
Forestry & Fisheries	326	224	- 102
Mining	9,423	3,489	- 5,934
SECONDARY ACTIVITIES	72,126	79,484	7,358
Contract Construction	10,763	9,926	- 837
Food & Kindred Products	4,030	5,788	1,758
Textile Mill Products	11,403	7,606	- 3,797
Apparel	10,230	12,085	1,855
Lumber, Wood Products, Furniture	6,108	5,402	- 706
Printing & Publishing	1,687	2,239	552
Chemicals & Allied Products	3,456	4,716	1,260
Electrical & Other Machinery	6,393	6,374	- 19
Motor Vehicles & Equipment	113	201	88
Other Transportation Equipt.	3,317	7,630	4,313
Other & Miscellaneous	14,626	17,517	2,891
TERTIARY ACTIVITIES	82,106	92,761	10,655
Transportation & Communications	13,178	10,089	- 3,089
Utilities & Sanitary Service	2,213	1,798	- 415
Wholesale Trade	3,806	3,854	48
Retail Trade	24,160	26,177	2,017
Finance, Ins. & Real Estate	3,053	4,172	1,119
Personal Services	11,687	11,117	- 570
Professional Services	17,400	27,019	9,619
Recreational Services	966	1,166	200
Public Administration	5,407	7,113	1,706
Armed Forces	236	256	20
NOT REPORTED	2,575	4,786	2,211

TABLE 3-14
SOCIO-ECONOMIC CHARACTERISTICS
PENNSYLVANIA STATE PLANNING SUB-REGION 8
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	556,300
Absolute Change 1960-1965	18,000
Percent Change 1960-1965	3.34

POPULATION 1960						
	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	538,295	264,847	273,448	43,318	258,137	236,840
Percent Distribution	100.00	49.20	50.80	8.05	47.95	44.00
Percent Change 1950-1960	7.19	6.05	8.32	-37.02	40.67	-5.22

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	16,988	13,912	59,030	35,230	11,236	136,396
Percent Distribution	12.45	10.20	43.28	25.83	8.24	100.00
Percent Change 1950-1960	-56.44	-58.03	43.66	517.53	649.07	9.26

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	302,114	129,080	134,715	34,600
Percent Distribution	100.00	42.73	44.59	11.45
Percent Change 1950-1960	5.39	-9.19	28.66	16.97

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	192,415	13,087	129,144	8,826	63,271	4,261
Percent Distribution	93.63	6.37	93.60	6.40	93.69	6.31
Percent Change 1950-1960	7.61	28.18	-0.11	2.78	27.74	162.54

RATE OF UNEMPLOYMENT, 1962-65

1962	8.0
1963	7.3
1964	5.8
1965	4.4

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	205,758	186,328	138,214	52,301	67,544	134,027
Percent Distribution	52.48	47.52	72.55	27.45	33.51	66.49
Percent Change 1950-1960	8.72	-1.21	0.11	8.46	31.94	-4.53

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	%
Tot. Work Force	215.5	6.3	3.0
Tot. Employment	206.0	13.6	7.1
Unemployment	9.5	-7.3	-43.5

State Planning Sub-region 7

The six counties of this sub-region are divided by the Allegheny Front into two sections. West of the Front is the rugged irregular topography of Somerset, Cambria, and Blair Counties. East of the Front, wooded ridges and cleared valleys dominate the largely rural character of Fulton, Bedford, and Huntingdon Counties.

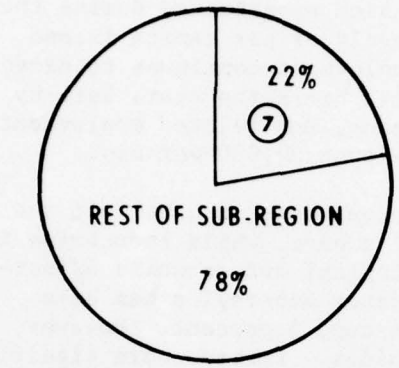
The principal urban centers within State Planning Sub-region 7 are Johnstown and Altoona whose Standard Metropolitan Statistical Areas account for more than one-third of the half million people who reside within these six counties. Johnstown is largely dependent on the steel industry for employment and income, while railroading still dominates the Altoona area. Employment in the railroad industry has declined drastically in recent years, but this has been offset to some extent by new industries. Farming also plays an important role throughout the area, along with bituminous coal mining and apparel industries.

In 1965, the total population of State Planning Sub-region 7 was about 502,000: about 163,000 of these made up the total civilian labor force, and of these, about 152,000 were employed. Declines in total population and the civilian labor force and total employment during the period 1960-1965 were respectively -1.6 percent, -8.7 percent, and -6.4 percent. The decline in total employment during this period was due largely to losses in the Services sector; manufacturing as a group experienced an increase in employment of about 4.3 percent.

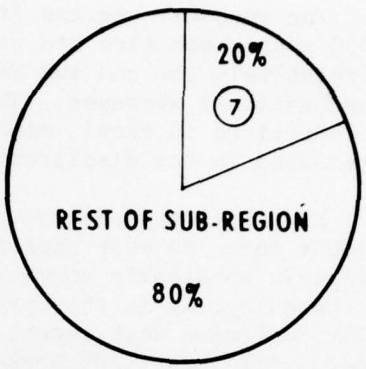
During the period 1960-1965, the only manufacturing category to experience a loss in employment was the Clay, Glass and Metals employment group (-1.3 percent). Employment in chemicals and petroleum was unchanged during the period, and gains among the other manufacturing sectors for the period were within the approximate range of 5 to 10 percent. The construction industry experienced a relatively large decline of about 33 percent; however, heavy losses were suffered in this sector throughout most of the Appalachian Region during the same period.

Among the non-manufacturing employment groups, two employment categories experienced increases during the period 1960-1965; Government employment increased 13.0 percent, and other private services increased 25.4 percent. Major declines were experienced in transportation and utilities (-44.0 percent) and mining (32.6 percent); relatively moderate declines in trade (-18.5 percent) and minor declines in agriculture, forestry and fisheries (-1.9 percent).

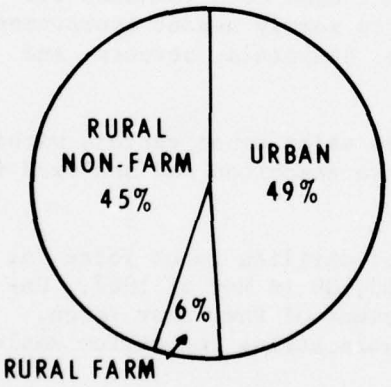
The civilian labor force in State Planning Sub-region 7 included about 163,000 persons in 1965: about 6 percent of these were unemployed.



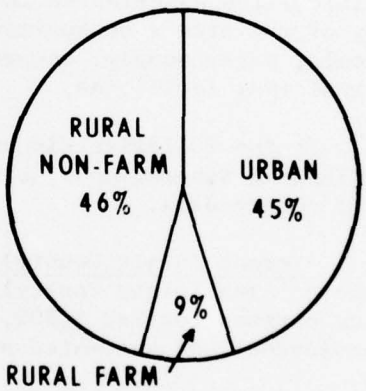
POPULATION "B" -1965



EMPLOYMENT "B" -1965



STATE PLANNING
SUB-REGION 7
1960



WATER SUB-REGION B
1960

Figure 3-24 - Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 7 Compared to Sub-region B.

The recovery process from a recession experienced during the late 1950's has been slow and painful. Levels of per capita income remain relatively low and the rate of unemployment continues to exceed state and national averages. The area still bears the scars left by sudden reductions in steel, mining, railroads, and related employment which resulted in the displacement of more than 30,000 workers.

Many have transferred to other occupations or have left the local labor force to seek opportunities elsewhere, while industries in the area have apparently completed technological and economic adjustments. Unemployment in this part of the water sub-region has been gradually declining with recent averages around 5 percent. However, in Altoona more than 3,600 workers are jobless. Perhaps more significant than the overall unemployment rates in the past 15 years, is the decreasing size of the civilian labor force. This reflects a reduction in productive capacity as well as the inability of the area to compete effectively in attracting desirable new industry and young workers with skills and training compatible with existing and anticipated needs. Many of the expanding industries which have located in this area are low-wage industries (textiles, apparel, leather, and food) which account for increasing percentages of female employment in manufacturing. The difficulties experienced in the economic base have weakened the ability of the area's communities to finance sorely needed improvements to schools, water supply, sewage treatment, hospitals, streets, and other municipal facilities.

In the following discussion of the major urban centers within State Planning Sub-region 7, the centers are described and analyzed in terms of county data.

Altoona (Blair County). The total civilian labor force for the Altoona Area (Blair County) numbered 53,600 in May of 1967. Unemployed persons totaled 3,900, or 7.3 percent of the labor force. Farm employment was estimated at 900. Manufacturing industries employed 14,300.

Blair County has a total area of 535 square miles in very mountainous areas. Nevertheless, fertile valleys separate the long, high mountain ridges. The population of Blair County is predominantly urban; 71.8 percent. Rural non-farm represents 22.9 percent of the total population, while rural farm comprises 5.3 percent. Dairy farming is the principal agricultural activity.

A vocational-technical school was opened in 1966. Approximately 40 percent of the students graduating from high school go on to higher education. The Altoona School of Commerce, St. Francis College, Juniata

College, the Altoona Campus of Pennsylvania State University, and the main campus of Pennsylvania State University at State College are within easy commuting distance of the region.

Although rail facilities are available, the lack of highway access has been a serious impediment to industrial development. North-south access is provided by U.S. Route 220, while U.S. Route 22 provides east-west access. Improvement of these routes will be designated Appalachian Corridors O and M. Altoona will be within easy driving distance of both Interstate 80 and the Pennsylvania Turnpike.

Motor freight service (seven major trucking firms) has been able to adequately handle industrial demand for service. Freight service should be able to expand to meet the area's needs in the future, especially when planned highway improvements are completed.

Commercial air service is provided by Allegheny Airlines from Blair County Airport, southeast of Altoona at Martinsburg.

At present, there are two zoned industrial parks located in the region with a total area of 88 acres.

The Altoona Water System is municipally owned. The city's six reservoirs with a total capacity of 2.125 billion gallons and a safe yield of 9.2 million gallons per day serve a population of 85,000. Increased storage capacity is planned for Mill Run and Lake Altoona Reservoirs. These improvements will increase the storage capacity of the system by 291 million gallons. The system with its planned improvements will fill immediate needs. Additional storage will be needed for new industry.

Strip and deep mining operations in the Blair Region*/ have created an extensive mine drainage problem. Mine acid is seeping into the region's reservoirs. Lake Altoona, for example, has a pH of 4.4. Hardness is an additional water problem in the area.

Each borough has its own sewage treatment plant, many of which provide only primary treatment. There is a need for higher treatment levels at many population centers, and the state is in the process of ordering towns with a population over 5,000 to provide secondary treatment. An estimated $11 to $13 million in improvements are needed. Antis Township has a critical need of sewers, for it is here that local officials anticipate industrial growth. Untreated sewage from very small communities is one of several factors contributing to the pollution of the Juniata River.

---

*/ Blair Region refers to three townships in Blair County which encompasses Altoona, Bellwood and Hollidaysburg.

The attitude of bankers toward industrial and residential lending is excellent. Local action groups have been very energetic in seeking new industry.

Over 73 percent of Altoona's housing was built prior to 1919 and 91.5 percent prior to 1929, during periods of railroad expansion. Of Altoona's housing, 20.1 percent have been designated substandard. In the county, 31.6 percent of the dwelling units are considered substandard. Altoona is in the process of a comprehensive urban renewal program which should remedy some of the city's housing problem.

The lumbering industry in Blair County is confined mainly to the production of pulp and pole timber. Hardwoods, red oak, white oak, sugar maple, yellow birch, and beech are predominant in Blair County. It is estimated that the region could support several more pulp board plants.

The mineral resources of the region are mainly the non-metallic type. The iron ores have little current economic value. The area has sufficient resources to support a considerable expansion in the limestone industry.

The Pennsylvania Electric Company, Eastern Division, serves Blair County. Natural gas is provided by The Peoples Natural Gas Company, a subsidiary of the Consolidated Natural Gas Company. District headquarters of the Bell Telephone Company are located in Altoona.

Additional recreation areas are needed in the region.

The Little Juniata River and the Frankstown Branch of the Juniata River are subject to organic pollution from Altoona, Hollidaysburg, Williamsburg, and Roaring Springs, and pulp wastes at Tyrone. Flow augmentation or tertiary treatment is needed.

Johnstown (Cambria County). Cambria County comprises an area of 695 square miles. Many rivers have their headwaters here. Clearfield and Chest Creeks form the West Branch of the Susquehanna River in the northeast section of the county. In the southwestern part of the county, Little Conemaugh, Blacklick and Stony Creeks form the Conemaugh River which eventually flows into the Allegheny and Ohio Rivers.

Fifty-eight percent of the county is in woodland consisting of second and third growth stands. Approximately 97 percent of the woodland is in tracts of 50 acres or more. The trend in woodland acreage is downward.

The total civilian work force of Cambria County was estimated at 92,000 in May of 1967. Unemployed numbered 4,600, 5 percent of the labor force. Farm employment totaled 2,900 people. Employment in manufacturing industries numbered 26,000 people.

The farm population in Cambria County decreased from 11,330 in 1950 to 6,700 in 1960. The number of farms and acreage in farms decreased, while the size of farms increased. In 1959, agricultural income amounted to $4.5 million, of which 28 percent was derived from dairy products, 13 percent livestock products, 27 percent from field crops, 29 percent from poultry products, 2.5 percent from vegetables, and 0.5 percent from fruits and nuts.

The Johnstown laborshed area ecompasses Somerset and Cambria Counties with some commuting from Indiana, Westmoreland, and Bedford Counties. While there is a surplus of labor in the Johnstown area, skill diversification is quite limited. The unskilled make up 60 percent of the unemployed total. There has been a significant amount of out-migration over the past ten years. There is a great demand for highly skilled workers, and 82 percent of those completing training or retraining programs are placed with local industry. Communication among industry, guidance counselors, industrial development groups, and the Bureau of Employment Security regarding the availability of jobs has been good. Labor market information machinery has been well used by jobseekers. Local officials believe that with the completion of the new vocational-technical school, the area will be able to adequately meet demands for skilled labor.

Lack of adequate access routes to the Johnstown area has been one of the major factors inhibiting the growth of the region. East-west access is provided by Pennsylvania Route 56. The north-south link is U.S. Route 219. The latter has been designated as Appalachian Corridor N and will link Johnstown with Interstate 80 to the north and the Pennsylvania Turnpike to the south. Local officials have realized the inadequacy of the present street and road system and have scheduled many improvements. With the completion of the Appalachian Corridors and local improvements projects, the area will be more readily accessible from all directions.

The county is served by the Penn-Central, Baltimore & Ohio, Western Maryland, and Cambria & Indiana Railroads. Freight service has been adequate in the past and is capable of expanding to meet future demands by industry. Within a thirty-mile radius of Johnstown, there are 18 truck terminals. Allegheny Airlines maintains scheduled flights into the area from Johnstown-Cambria Airport, but improvement is needed in the airport facilities.

There are no industrial sites available in Johnstown proper; however, Johnstown does have an industrial park located at the intersection

of U.S. 219 and Elton Road in Tichland Township. It is approximately 5 miles from downtown Johnstown and about 72 miles east of Pittsburgh. Water, sewers, and other facilities are in place, but rail service is not available. A number of other sites are available; however, many of these are without the necessary utilities. Recent suburban and industrial growth has been centered in Richland, Stony Creek, and Upper Yoder Townships. Many interested citizens feel that the prime sites are located north of Johnstown in the Ebensburg area. Problems associated with the development of industrial sites have included polluted water, lack of adequate transportation facilities and lack of sewage disposal plants.

The Greater Johnstown Area is served by the Greater Johnstown Water Authority and the Highland Sewer and Water Authority. Existing storage facilities of the general system total 274 million gallons, with daily use between 2 and 2-1/2 million gallons. Primary sources of water are from reservoirs, located on the western slopes of the Allegheny Mountains, the most important being the Loydell Reservoir, the two Bear Rock Reservoirs and the Sandy Run Reservoir.

The sewage system of Johnstown is being used to capacity. The system is old and in need of modernization. Sewage is given primary treatment at a single sewage treatment facility. Secondary treatment is required. Most of the area to the east of Johnstown, where growth is expected to occur, has no sewer system.

The attitude of local financial agencies toward industrial and residential lending is good. Also, the community will aid industry with manpower training programs and will build "feasible" local access roads for industry.

In 1966, there were 70,970 housing units in Cambria County. Of these units, 71.5 percent were owner-occupied. Approximately 66.3 percent of the units were built prior to 1949, while 16.5 percent were built since 1954. Deteriorating or dilapidated housing made up 21.5 percent of total units occupied. In low income areas, deteriorating and dilapidated housing ranged from 25-50 percent of the total occupied housing units. Johnstown is in the process of developing an urban renewal program. Local officials believe that many of the housing problems will be alleviated with the completion of this program.

Cambria County has the natural resources, if developed to meet the increasing demand for many types of recreation. Picturesque, rugged mountains and a cool climate have attracted thousands of tourists and vacationers annually. Historic sites are numerous.

Prince Gallitzin State Park will be the outstanding recreational center in Cambria County, when its development is completed. Facilities will include picnicking, swimming, boating, family camping, tent and trailer group camping, skiing, ice skating, conservation education, hiking, fishing, and hunting. Included in the Park will be "Naturealm," an intensified conservation educational area. Here at one spot, and within a few hours, those interested would learn about the present and past uses and abuses of soils, waters, forests, and wildlife. At the same time, they would receive a basic introduction to the more important accomplishments and problems of resources management. Duman Lake between Belsano and Nicktown is another center for picnics, sports, and family entertainment.

Large areas of the northeastern and northwestern parts of the county have been strip mined. Pollution from mine spoils has made much of the water in these areas unsuitable for fish life, recreation, municipal, and industrial uses.

A few strip mine operators have done a laudable job of backfilling and planting the culm piles; however, the majority of the disturbed lands remain an eyesore for the area. The prime objective should be to regrade and cover these areas with some form of vegetation.

In general, Cambria County has inadequate water supplies caused by acid water from coal fields, domestic sewage, and highway salt. The lack of foresight and planning has resulted in the destruction of many watershed areas.

Employment by major categories and socio-economic characteristics of Pennsylvania State Planning Sub-region 7 are shown in Tables 3-15 and 3-16.

TABLE 3-15
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
PENNSYLVANIA STATE PLANNING SUB-REGION 7

	1950	1960	Absolute Change
TOTAL ALL SECTORS	168,674	160,444	- 8,230
PRIMARY ACTIVITIES	36,037	15,044	-20,993
Agriculture	12,125	7,363	- 4,762
Forestry & Fisheries	163	105	- 58
Mining	23,749	7,576	-16,173
SECONDARY ACTIVITIES	44,623	54,355	9,732
Contract Construction	7,941	8,151	210
Food & Kindred Products	2,943	3,689	746
Textile Mill Products	1,630	1,439	- 191
Apparel	4,720	6,558	1,838
Lumber, Wood Products, Furniture	2,353	1,850	- 503
Printing & Publishing	1,528	1,721	193
Chemicals & Allied Products	387	314	- 73
Electrical & Other Machinery	733	2,578	1,845
Motor Vehicles & Equipment	179	273	94
Other Transportation Equipt.	364	889	525
Other & Miscellaneous	21,845	26,893	5,048
TERTIARY ACTIVITIES	86,081	87,848	1,767
Transportation & Communications	24,583	17,715	- 6,868
Utilities & Sanitary Service	2,170	2,348	178
Wholesale Trade	3,817	3,707	- 110
Retail Trade	24,225	25,525	1,300
Finance, Ins. & Real Estate	2,743	3,749	1,006
Personal Services	10,657	10,065	- 592
Professional Services	12,301	18,222	5,921
Recreational Services	984	838	- 146
Public Administration	4,415	5,442	1,027
Armed Forces	186	237	51
NOT REPORTED	1,933	3,197	1,264

TABLE 3-16
SOCIO-ECONOMIC CHARACTERISTICS
PENNSYLVANIA STATE PLANNING SUB-REGION 7
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	511,300
Absolute Change 1960-1965	800
Percent Change 1960-1965	0.16

POPULATION 1960						
		Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number		510,508	249,982	260,526	29,936	232,381	248,191
Percent Distribution		100.00	48.97	51.03	5.86	45.52	48.92
Percent Change 1950-1960		-2.37	-4.14	-0.61	-50.00	14.72	-4.71

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	18,864	15,137	56,977	30,054	8,753	129,785
Percent Distribution	14.53	11.66	43.90	23.16	6.74	100.00
Percent Change 1950-1960	-52.16	-57.31	35.14	379.71	525.21	1.04

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	288,988	135,850	122,472	24,729
Percent Distribution	100.00	47.01	42.38	8.56
Percent Change 1950-1960	-1.30	-15.09	22.90	14.94

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	160,207	15,044	112,471	11,965	47,736	3,079
Percent Distribution	91.42	8.58	90.38	9.62	93.94	6.06
Percent Change 1950-1960	-4.91	38.45	-14.44	31.86	28.89	71.82

RATE OF UNEMPLOYMENT, 1962-65

1962	13.2
1963	10.4
1964	7.8
1965	6.0

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	175,488	188,011	124,669	50,332	50,819	137,679
Percent Distribution	48.28	51.72	71.24	28.76	26.96	73.04
Percent Change 1950-1960	-2.26	-7.49	-11.38	3.17	30.78	-10.86

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	%
Tot. Work Force	174.1	- 0.7	- 0.4
Tot. Employment	163.6	11.9	7.8
Unemployment	10.5	-12.6	-54.6

Water Area B-3

Water Area B-3 contains Maryland State Planning Sub-region 37 and West Virginia State Planning Sub-region 19.

State Planning Sub-region 37

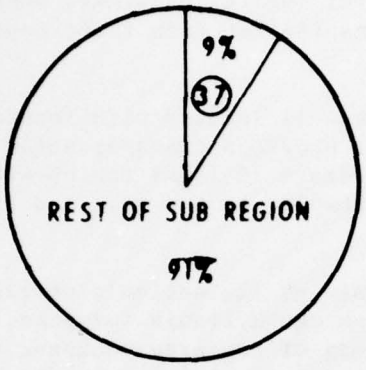
The three Appalachian counties of Maryland (Allegany, Garrett, and Washington) are closely related to the eastern panhandle of West Virginia and the counties of south central Pennsylvania. While the area has suffered from the decline of employment in coal mining and railroading, it has been relatively successful in attracting new forms of economic activity to take their place. Growth in employment has exceeded population growth in both Garrett and Washington Counties. The location of new manufacturing plants has occurred largely in Washington County, which has accommodated 9 manufacturing plants since 1960, each employing over 50 persons.

The 1965 population of State Planning Sub-region 37 was about 210,000 people. Of the approximately 81,000 in the total civilian labor force, 75,600 were employed. During the period 1960-1965, the total population increased 6.9 percent, the total civilian labor force increased 12.1 percent. Increases in the manufacturing sector were about three times as great as those in service industries.

During the period 1960-1965, all employment groups within the manufacturing sector experienced increases in employment. The largest relative gains were in chemicals and petroleum (28.3 percent) and machinery and miscellaneous (28.2 percent). The remaining manufacturing groups all experienced increases within the approximate range of 20 to 25 percent. The construction industry increased only slightly during the period (2.5 percent).

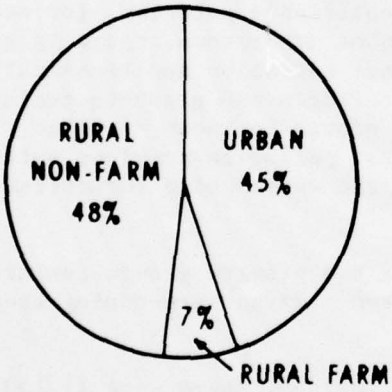
Among the non-manufacturing employment groups, only transportation and utilities experienced a decline in employment (-36.6 percent) during the period 1960-1965. As in most of the state planning sub-regions within the water sub-region, Government and other private services both showed large relative gains, i.e., 30.6 percent and 27.0 percent, respectively. While mining employment remained unchanged during the period, agriculture, forestry, and fisheries increased about 20 percent; a percentage change which was approximately double that for the wholesale and retail trade sector during the period 1960-1965.

The unemployed numbered 5,700 in 1965; this represents a rate of 5.8 percent. The number of persons unemployed decreased 7.5 percent during the period 1960-1965.

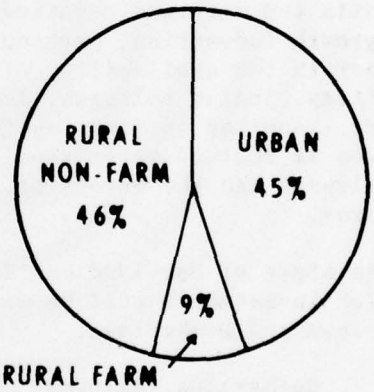


POPULATION "B" -1965

EMPLOYMENT "B" -1965



STATE PLANNING
SUB-REGION 37
1960



WATER SUB-REGION B
1960

Figure 3-25 - Population, Employment, and Urban-Rural Population Distribution of State Planning Sub-region 37 Compared to Sub-region B.

Several impediments to diversified development of the area such as transportation, training of labor, and water quality problems, must be removed, if the Maryland Counties are to capitalize upon their opportunities for growth.

The area centered around Hagerstown is well located with respect to access to national markets. Interstate 81 provides transportation to markets of the north and south while Interstate 70 links the Hagerstown area with the Baltimore-Washington, D.C. complex to the east and the Pittsburgh-Cincinnati complex to the west.

The City of Cumberland has been bypassed by the nation's developing transportation network; the location of the Pennsylvania Turnpike, and the shift from trains to trucks as conveyors of commerce weakened the city's traffic position on the railroads. Construction of Appalachian Development Highway Corridor E will provide a vital transportation link for Cumberland. The Corridor connects Cumberland with the Hagerstown and Baltimore-Washington, D.C. areas to the east and the Pittsburgh, Pennsylvania-Cincinnati, Ohio areas to the west. In addition, Appalachian Development Highway Corridor O effectively integrates Cumberland with the markets to the north in Pennsylvania.

While the Maryland counties have identifiable potential for many high growth industries, particularly around Hagerstown, there is a deficiency in the availability of vocational education and technical facilities, junior colleges, four-year colleges and graduate training centers. Another serious impediment to growth in these Maryland counties is that of water supply and water pollution problems which have already had the effect of limiting the water-using industries in this area.

The State of Maryland has identified two primary growth centers in which investments will be made to serve a large surrounding area: Hagerstown and Cumberland.

Cumberland (Allegany County). In 1966, there were 11,130 persons employed by manufacturing in Allegany County in establishments with more than 50 employees. Of these, about 75 percent were employed in the City of Cumberland. The remainder were employed in surrounding communities.

The Cumberland Renewal Agency has pointed out that Cumberland's primary trade area should encompass an area which is 40 to 50 minutes driving time from the city. The population of the Cumberland primary trade area, thus defined, was 121,070 in 1960 and 128,050 in 1966. When Appalachian Corridor E is completed, driving times from northern Garrett County to Cumberland should be greatly reduced. In effect, this would increase Cumberland's primary trade area.

Cumberland has two industrial sites ready for immediate use with all the necessary access roads, water and sewer, and other utilities already in place. One 56-acre industrial park was developed and is owned by Cumberland-Allegany County Industrial Foundation, Inc., with the financial support of the city's business community. Another 103-acre park owned by the Western Maryland Railway is near a large Pittsburgh Plate Glass Company plant. Both are just outside the city limits. A third site under multiple ownership consists of 1,150 acres, 5 1/2 miles south of the city limits. It lies between U.S. Route 220 and the Potomac River. Both the Baltimore & Ohio and the Western Maryland Railways run through its entire length.

Well served by two major railroads (one of which recently built a $13 million freight classification yard in the city), by U.S. Route 220, and by U.S. Route 40 east to Hancock, where it connects with Interstate 70, Cumberland should become even more attractive to new or expanded industries when Appalachian Corridor E is completed. While U.S. Route 220 is already an important north-south highway through Cumberland, it needs considerable improvement unless Appalachian Corridor O is built in the near future.

Cumberland has the only four-year liberal arts college in Appalachian Maryland. Frostburg State College, 10 miles from the downtown area, now has over 2,000 students. The college plans to expand into graduate fields concentrating first on areas of study which will satisfy the needs of the business and industrial community. This college is an important cultural asset for all of Appalachian Maryland.

Frostburg State College will be complemented by two new facilities, the Allegany Community College and the Allegany County Area Vocational-Technical Center. The latter will be located near the Celanese Fibers Company Plant, which donated 15 acres for the purpose.

Cumberland has also embarked on an urban renewal project planned in three phases from 1965 to 1975. This will involve the redesign and redevelopment of the entire downtown area of the city.

Hagerstown (Washington County). Manufacturing plants in Washington County, employing over 50 persons in December 1966, are concentrated in the City of Hagerstown. Four other communities within the Hagerstown area had plants with more than 50 employees.

Hagerstown has made considerable progress since 1960 in attracting a wide variety of new industries. Nine plants, with a total employment in December 1966 of 5,333, have located here, including Mack Truck with 3,614 employees.

Hagerstown is strategically located at the juncture of Interstate Highways 81 and 70. It is the largest community in the Great Valley

between Harrisburg, Pennsylvania, and Roanoke, Virginia. It is near the urban centers of Washington and Baltimore.

The area provides educational and cultural facilities for the region. Washington County has had an aggressive school building program for many years. Under the sponsorship of the Ford Foundation, the County instituted the first use of educational television in classrooms with a county-wide closed circuit ETV network. Hagerstown Junior College has a full-time enrollment of over 600 students. The Washington County Economic Development Commission has been leading a local effort to establish a new four-year college or branch of the University of Maryland. This movement has gained a great deal of civic support.

The Washington County Museum of Fine Arts, located in the Hagerstown City Park, is a unique institution for an area of this size. The museum conducts a wide variety of cultural programs including concerts, lectures, art classes, and children's programs. The area abounds in historical attractions such as Antietam Battlefield, the C&O Canal, and Old Fort Frederick.

Hagerstown's long standing as a shopping center will be even further boosted by the plans of the Western Maryland Railway Company to develop a large regional shopping center near the intersection of Interstate Routes 70 and 81. A large civic center is planned near the center of town.

The area's successful industrial development programs have resulted in the creation of several industrial park areas. The first, 150 acres owned by the city, now contains eight new plants. The Hagerstown Municipal Airport Industrial Park, also owned by the city, has one major plant under construction and sites provided for five future facilities. The Interstate Industrial Park, containing more than 300 acres, is being publicly developed at the interchange of Interstate 81 and U.S. Route 11. Approximately 1,000 acres of privately owned property are also in reserve for industrial use. About 800 acres of this property are in control of railroads.

An example of Hagerstown's importance as a regional center is evidenced by the recent location of a five-state distribution center for Chrysler products. The Hagerstown Municipal Airport also serves a regional need in providing both commercial and general aviation functions. Recent discussions with the City of Chambersburg, Pennsylvania, point to the possibility of official acceptance of this airport as serving both areas. In addition, the location of the huge Fairchild-Hiller plant adjacent to the airport assures continuing importance to the economy of the area.

Secondary growth centers are located at Westernport, Oakland-Deep Creek Lake, and Hancock. Westernport and adjacent Luke contain paper

factories and the hinterland could become a center of tourism. The Deep Creek Lake area is growing as a recreation center with 175,000 visitors in 1967. Hancock (population 2,004) although small, is strategically located between Cumberland and Hagerstown. It is on Interstate 70 and U.S. 522. The citizens of the community are working hard to attract small industry.

Employment by major categories and socio-economic characteristics of Maryland State Planning Sub-region 37 are shown in Tables 3-17 and 3-18.

TABLE 3-17
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
MARYLAND STATE PLANNING SUB-REGION 37

	1950	1960	Absolute Change
TOTAL ALL SECTORS	64,352	66,509	2,157
PRIMARY ACTIVITIES	6,777	4,269	- 2,508
Agriculture	5,202	3,462	- 1,740
Forestry & Fisheries	45	112	67
Mining	1,530	695	- 835
SECONDARY ACTIVITIES	23,489	24,523	1,034
Contract Construction	3,497	4,094	597
Food & Kindred Products	1,262	1,684	422
Textile Mill Products	1,253	586	- 667
Apparel	903	1,250	347
Lumber, Wood Products, Furniture	1,359	1,245	- 114
Printing & Publishing	637	934	297
Chemicals & Allied Products	4,621	3,341	- 1,280
Electrical & Other Machinery	1,230	1,717	487
Motor Vehicles & Equipment	45	25	- 20
Other Transportation Equipt.	3,352	2,957	- 395
Other & Miscellaneous	5,330	6,690	1,360
TERTIARY ACTIVITIES	33,253	35,363	2,110
Transportation & Communications	7,888	6,537	- 1,351
Utilities & Sanitary Service	1,043	1,127	84
Wholesale Trade	1,630	1,699	69
Retail Trade	9,855	10,188	333
Finance, Ins. & Real Estate	1,276	1,526	270
Personal Services	4,671	4,403	- 268
Professional Services	4,581	6,705	2,124
Recreational Services	544	445	- 99
Public Administration	1,659	2,139	480
Armed Forces	106	594	488
NOT REPORTED	833	2,354	1,521

TABLE 3-18
SOCIO-ECONOMIC CHARACTERISTICS
MARYLAND STATE PLANNING SUB-REGION 37
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	214,200	Number	195,808	95,680	100,128	12,494	94,671	88,643
Absolute Change 1960-1965	18,400	Percent Distribution	100.00	48.86	51.14	6.38	48.35	45.27
Percent Change 1960-1965	9.40	Percent Change 1950-1960	3.22	2.20	4.21	-44.26	46.02	-13.48

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	7,216	5,188	20,354	13,696	4,689	51,143
Percent Distribution	14.11	10.14	39.80	26.78	9.17	100.00
Percent Change 1950-1960	-55.47	-55.20	27.37	451.15	525.20	4.45

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	111,969	55,220	44,771	10,907
Percent Distribution	100.00	49.32	39.99	9.74
Percent Change 1950-1960	3.62	-7.10	21.66	26.60

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	65,915	5,622	46,748	3,972	19,167	1,650
Percent Distribution	92.14	7.86	92.17	7.83	92.07	7.93
Percent Change 1950-1960	2.60	0.41	-3.00	-7.82	19.41	27.91

RATE OF UNEMPLOYMENT, 1962-65

1962	8.1
1963	8.1
1964	7.0
1965	5.8

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	72,131	59,653	51,208	17,052	20,923	52,601
Percent Distribution	50.87	49.13	75.02	24.98	28.46	71.54
Percent Change 1950-1960	3.12	-0.24	-2.63	9.84	20.53	-3.31

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	75.8	0.4	0.5
Tot. Employment	71.4	2.1	3.0
Unemployment	4.4	-1.7	-27.9

Includes persons in the Armed Forces.

State Planning Sub-region 19

West Virginia State Planning Sub-region 19, located in the northeastern corner of the state, consists of the following eight counties: Morgan, Berkeley; Jefferson; Mineral; Hampshire; Grant; Hardy and Pendleton. Topographically, the Sub-region is featured by broad and level valleys between rugged mountain ridges.

In 1965, the total population of State Planning Sub-region 19 was about 117,000. Of a total civilian labor force of about 39,000, about 34,000 were employed. During the period 1960-1965, the population decreased 2.8 percent, while the civilian labor force decreased 13.2 percent, and the number of persons employed decreased 17.4 percent.

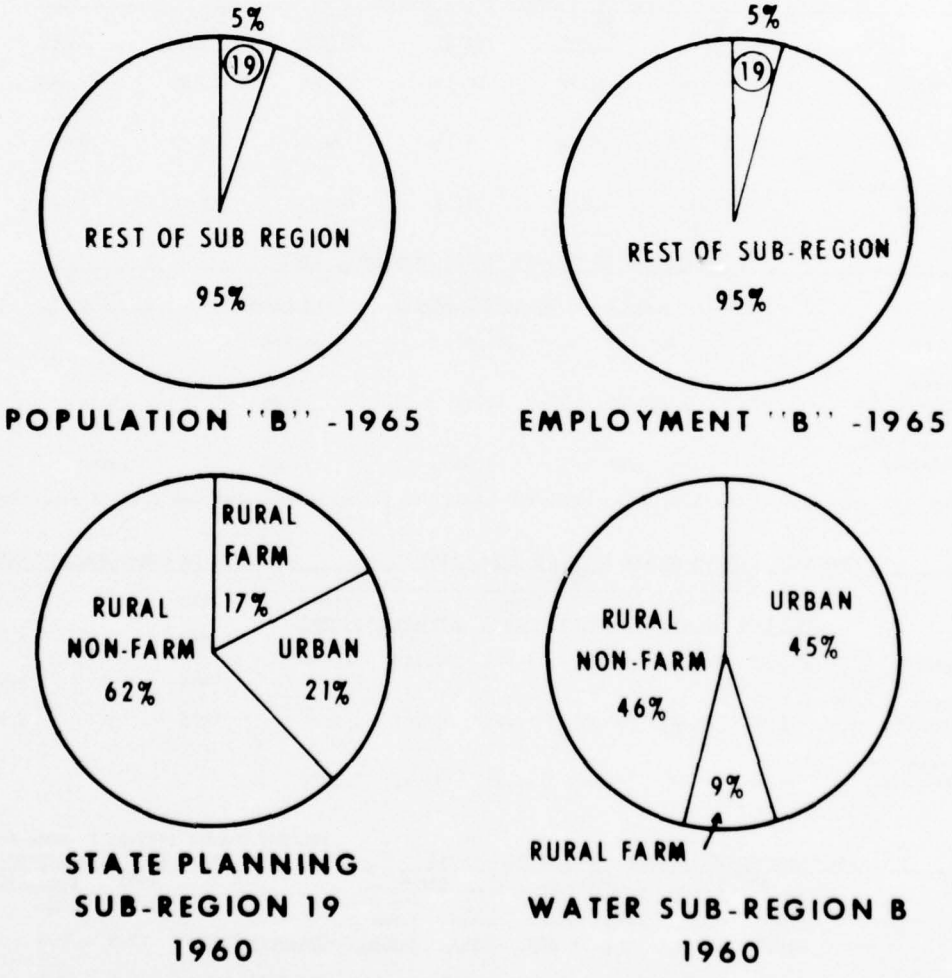


Figure 3-26 - Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 19 Compared to Sub-region B.

Every employment group within the manufacturing sector experienced a decline in employment during the period 1960-1965. The losses ranged from -38.1 percent in the clay, glass, and metal employment group to -20 percent in chemicals and petroleum. The construction industry showed an increase of 16.0 percent for the period. This increase represents a break in the pattern of losses throughout most of the water sub-region in the construction industry.

Of the non-manufacturing employment sectors, mining experienced the largest rate of growth during the period 1960-1965 (233.3 percent). The only other sector showing growth was government, with an increase of 21.4 percent for the period. The declining employment groups experienced the following losses: transportation and utilities, -47.2 percent; agriculture, forestry, and fisheries, -35.3 percent; wholesale and retail trade, -30.7 percent; and other private services, -3.1 percent.

The unemployment rate decreased 30.8 percent during the period 1960-1965. In 1965, there were 3,500 unemployed; the unemployment rate was 8.2 percent.

The transportation system in this area is rapidly improving primarily because of the imminent construction of interstate and Appalachian highways. Substantial new industrial construction has been occurring in this general region improving the economic health of the entire area. The improved highway system will make available new industrial sites.

These counties have a serious deficiency in urban services. Improvements will be required in vocational education and associated educational facilities. All types of urban services need to be improved, if the area is to capitalize on its potentials.

Manufacturing employs more people than does agriculture, but manufacturing industries are fairly well concentrated in the larger towns. Principal manufactured products are apparel, glass, electronics, and wood products. The output of sand and limestone is an important activity. Coal mining is virtually non-existent in these counties, except for small operations in Grant County.

This area leads all other regions in West Virginia in agriculture; it produces three-fourths of all the fruit and more than one-third of all the livestock sold in West Virginia. The area ranks high in popularity among tourists.

Martinsburg, population 15,197 in 1960, is the largest of the 20 incorporated municipalities in State Planning Sub-region 19. This city is a center of economic activity in the West Virginia portion of Water Area B-3.

The sub-region has two state supported colleges - Potomac State at Keyser and Shepherd College at Shepherdstown. The State School for the Deaf and Blind is located at Romney.

This region has inadequate highway transportation facilities. Interstate 81, which crosses the Eastern Panhandle at Martinsburg, provides high-speed transportation. Four other federal routes and a number of state routes also criss-cross the region.

One section of the Appalachian Highway System, Corridor H, from Weston, West Virginia to near Winchester, Virginia, will cross the southern part of Water Area B-3, and Corridor E will cross the northern part of the water area in Maryland. Martinsburg will have access to both of these corridors via Interstate 81.

The potential of this area for industrial development is enhanced by nearness to the large population centers of the east and good industrial sites with water and electric power. There exists an excellent potential for further development of tourism and recreation. In the number and variety of historical, scenic and other attractions that it offers for visitors, this region is unsurpassed in West Virginia, and ranks high in the nation. These advantages, coupled with the nearness to the huge metropolitan centers of the east, are likely to result in further development.

Noteworthy public recreation resource areas include Harpers Ferry National Historical Park, parts of the Monongahela and George Washington National Forests, the new Spruce Knob - Seneca Rocks National Recreation Area and eight state-owned areas, including two of the more popular state parks, Cacapon and Lost River. For the horse race fans, there are two tracks located near Charles Town.

Urban Centers. The two most important urban centers in the Potomac Basin are Cumberland and Hagerstown, Maryland.

In the northern part of the Potomac Basin, Cumberland is the focus of commuting and trade for Allegany County, Maryland, and Hampshire and Mineral Counties, West Virginia. Cumberland is a rail center, a coal shipping point, and a manufacturing city. Those West Virginia counties which center on Cumberland are mountainous and mostly wooded with large uninhabited sections. Dairying, plus general and subsistence farming, are carried on in valleys between the long mountain ridges. Completion of east-west Development Corridor E and secondary roads through this area will accelerate the sub-region's recreational development by bringing it within easy driving distance of both the Pittsburgh and Baltimore-Washington areas.

Berkeley, Jefferson, and Morgan Counties, West Virginia, as well as Washington County, Maryland are oriented to Hagerstown, Maryland for employment and trading. Principal industries in Hagerstown include aircraft and truck equipment industries and varied manufacturing. Because of the high proportion of open, level to rolling land in the counties centered on Hagerstown, commercial rather than residential type farming is important, with dairying, livestock, and fruit growing the main agricultural activities. A more detailed discussion of the urban centers of Hagerstown and Cumberland was provided previously under Maryland State Planning Sub-region 37.

Secondary growth centers, although small, can add to an improved economy of the area. These are the Piedmont-Keyser area, and the Romney-Moorefield-Petersburg area.

Petersburg is ranked as a supplemental investment area, which indicates a strategy to make investments which would make the area more attractive to new investment and provide urban services to serve surrounding rural areas as well as the center. Appalachian Corridor H will enhance the locational advantages of the area. While the shortage of land with favorable terrain is not as severe as for many portions of West Virginia, the present occurrence of heavy flooding damage indicates the pressure for flood plain development. The flood plain at Petersburg is serviced by rail and highway systems and has substantial advantages for industrial development due to its proximity to the eastern markets. Effective water control measures in connection with flood plain management programs can be utilized to guide development of the area in a manner which will stimulate economic development of the area.

State Planning Sub-region 19 has a good potential for recreation development. It has several state parks, national forest areas, limestone caverns, and areas of historical interest related to the founding of our nation and the civil war. The scenery is outstanding and water resources impoundments would help stimulate tourism and year round recreational development.

Employment by major categories and socio-economic characteristics of West Virginia State Planning Sub-region 19 are shown in Tables 3-19 and 3-20.

TABLE 3-19
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
WEST VIRGINIA STATE PLANNING SUB-REGION 19

	1950	1960	Absolute Change
TOTAL ALL SECTORS	39,193	38,502	- 691
PRIMARY ACTIVITIES	11,824	6,959	- 4,865
Agriculture	10,187	6,059	- 4,128
Forestry & Fisheries	59	41	- 18
Mining	1,578	859	- 719
SECONDARY ACTIVITIES	10,008	11,918	1,910
Contract Construction	2,240	2,635	395
Food & Kindred Products	732	969	237
Textile Mill Products	2,210	1,633	- 577
Apparel	619	909	290
Lumber, Wood Products, Furniture	1,270	1,393	123
Printing & Publishing	193	353	160
Chemicals & Allied Products	332	704	372
Electrical & Other Machinery	408	496	88
Motor Vehicles & Equipment	5	24	19
Other Transportation Eqipt.	359	268	- 91
Other & Miscellaneous	1,640	2,534	894
TERTIARY ACTIVITIES	16,501	18,901	2,400
Transportation & Communications	3,474	3,464	- 10
Utilities & Sanitary Service	453	386	- 67
Wholesale Trade	544	648	104
Retail Trade	4,173	5,115	942
Finance, Ins. & Real Estate	445	672	227
Personal Services	2,580	2,413	- 167
Professional Services	3,465	4,412	947
Recreational Services	365	434	69
Public Administration	955	1,296	341
Armed Forces	47	61	14
NOT REPORTED	860	724	- 136

TABLE 3-20
SOCIO-ECONOMIC CHARACTERISTICS
WEST VIRGINIA STATE PLANNING SUB-REGION 19
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	125,000	Number	120,596	60,324	60,272	20,929	74,967	24,700
Absolute Change 1960-1965	4,400	Percent Distribution	100.00	50.02	49.98	17.35	62.16	20.49
Percent Change 1960-1965	3.65	Percent Change 1950-1960	1.49	1.24	1.73	-44.33	39.70	-10.40

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	7,113	4,421	11,369	5,553	1,698	30,134
Percent Distribution	23.60	14.67	37.73	18.36	5.63	100.00
Percent Change 1950-1960	-47.33	-28.92	75.18	668.47	540.75	5.79

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	66,759	38,680	19,998	6,680
Percent Distribution	100.00	57.94	29.96	10.01
Percent Change 1950-1960	3.78	-7.11	39.70	17.61

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	38,441	3,440	27,818	2,369	10,623	1,071
Percent Distribution	91.79	8.21	92.15	7.85	90.84	9.16
Percent Change 1950-1960	-1.80	95.01	-9.96	71.54	28.76	179.63

RATE OF UNEMPLOYMENT, 1962-65

1962	10.3
1963	9.5
1964	8.0
1965	8.2

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	41,942	43,839	30,248	12,340	11,694	31,499
Percent Distribution	48.89	51.11	71.02	28.98	27.07	72.93
Percent Change 1950-1960	2.40	-0.64	-6.41	21.34	35.39	-7.22

In des persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	42.8	0.4	0.9
Tot. Employment	39.3	1.3	3.4
Unemployment	3.5	-0.9	-20.5

DEVELOPMENT
OF
WATER RESOURCES
IN
APPALACHIA

MAIN REPORT
PART II
SHAPING A PLAN

CHAPTER 4 - SHAPING THE PLAN FOR SUB-REGION B

TABLE OF CONTENTS

Par.	Subject	Page II-4-
	SECTION I - FUTURE GROWTH PATTERNS	
1	WATER SUB-REGION B	1
	Other Studies in Progress	1
	Appalachian Water Resources Study	2
2	STATE PLANNING SUB-REGIONS	6
3	DEVELOPMENT C ONSTRAINTS	9
4	PATTERN OF GROWTH ANTICIPATED	9
	Water Area B-1	9
	Water Area B-2	10
	Water Area B-3	11
	SUB-REGION B	11
	SECTION II - WATER RELATED NEEDS	
5	INTRODUCTION	15
6	WATER RESOURCES NEEDS IN SUB-REGION B	15
	The Problem in General	15
	Flood Control	15
	Watershed Land Management	16
	Water Supply	17
	Maintenance of Stream Quality	20
	Navigation	23
	Power	23
	Recreation, Hunting and Fishing	23

CHAPTER 4 - SHAPING THE PLAN FOR SUB-REGION B

TABLE OF CONTENTS (CONT'D)

Par.	Subject	Page II-4-
7	WATER RESOURCES NEEDS BY GROWTH COMPLEXES AND STATE PLANNING SUB-REGIONS	25
	State Planning Sub-region 1 - New York	25
	State Planning Sub-region 2 - New York	26
	State Planning Sub-region 9 - Pennsylvania	27
	State Planning Sub-region 8 - Pennsylvania	28
	State Planning Sub-region 7 - Pennsylvania	29
	State Planning Sub-region 37 - Maryland	29
	State Planning Sub-region 19 - West Virginia	29
	Other Needs of Sub-region B	30
	SECTION III - ALTERNATIVES FOR MEETING NEEDS	
8	STRUCTURAL	31
9	NON-STRUCTURAL	31
10	APPLICATION OF ALTERNATIVES	31
	State Planning Sub-region 1 - New York	32
	Hornell-Alfred Growth Center	32
	Bath (Coshocton Valley-Hammondsport Growth Center)	32
	Corning-Elmira (Elmira-Chemung Growth Center)	33
	State Planning Sub-region 2 - New York	34
	Susquehanna Valley Growth Complex (Oneonta, Unadilla, and Sidney)	32 34
	Chenango Valley Growth Complex	35
	Ithaca-Cortland Growth Complex	35
	Binghamton-Owego-Susquehanna Growth Center	36
	Other Areas	37
	State Planning Sub-region 9 - Pennsylvania	37
	State Planning Sub-region 8 - Pennsylvania	40
	State College Growth Complex	40
	Lock Haven Growth Complex	40

CHAPTER 4 - SHAPING THE PLAN FOR SUB-REGION B

TABLE OF CONTENTS (CONT'D)

Par.	Subject	Page II-4-
	Williamsport Growth Complex	41
	Sunbury-Milton Growth Complex	41
	Other Problems	42
	State Planning Sub-region 7 - Pennsylvania	45
	Altoona Growth Center	45
	Other Problem Areas	46
	State Planning Sub-region 37 - Maryland	47
	Cumberland Growth Center	47
	Hagerstown Growth Center	48
	Other Problem Areas	49
	State Planning Sub-region 19 - West Virginia	50
	Luke-Keyser Growth Center	51
	Petersburg Growth Center	51
	Moorefield Growth Center	51
	Romney Growth Center	52
	Berkeley Springs Growth Center	52
	Martinsburg Growth Center	52
	Other Problem Areas	52
	Other Needs in Sub-region B	54
	SECTION IV - EVOLUTION OF THE SUB-REGION WATER RESOURCES DEVELOPMENT PLAN	
11	PLANNING CONSIDERATIONS	57
	State Planning Sub-region 1 - New York	57
	Hornell-Alfred Growth Center	58
	Bath (Coshocton Valley-Hammondsport Growth Center)	58
	Elmira (Elmira-Chemung Valley Growth Center)	58
	Others	59
	A Tentative Program	59

CHAPTER 4 - SHAPING THE PLAN FOR SUB-REGION B

TABLE OF CONTENTS (CONT'D)

Par.	Subject	Page II-4-
	State Planning Sub-region 2 - New York	63
	Susquehanna Valley Growth Complex (Oneonta, Unadilla, and Sidney)	63
	Chenango Valley Growth Complex	63
	Ithaca-Cortland Growth Complex	63
	Binghamton-Owego-Susquehanna Growth Center	64
	Others	64
	A Tentative Program	65
	State Planning Sub-region 9 - Pennsylvania	69
	State Planning Sub-region 8 - Pennsylvania	73
	State Planning Sub-region 7 - Pennsylvania	77
	State Planning Sub-region 37 - Maryland	81
	State Planning Sub-region 19 - West Virginia	82
12	SUMMARY OF PLAN	87
	Component I	87
	Water Area B-1	89
	Water Area B-2	90
	Water Area B-3	91
	Sub-region B	92
	Component II	94
	Water Area B-1	95
	Water Area B-2	97
	Water Area B-3	97
	Sub-region B	98
	Component III	99
13	ADEQUACY	103
14	IMPLEMENTATION	106
15	COSTS, BENEFITS, AND INDICES	108

CHAPTER 4 - SHAPING THE PLAN FOR SUB-REGION B

LIST OF TABLES

Table No.	Title	Page II-4-
4-1	Population and Employment, Historical and Projected; Population and Employment, Developmental Benchmarks - Water Sub-region B	4
4-2	Developmental Benchmarks Data for State Planning Sub-regions in Water Sub-region B	6
4-3	Additional Needs for Water Supply and Water Quality Improvements	19
4-4	Untreated Waste Loadings (P.E. in 1,000's) Accruing from Benchmark Goals	21
4-5	Total Recreation Needs in Water Sub-region B (Millions of Recreation Days)	24
4-6	Conservation Treatment Needs for Agricultural Lands	30
4-7	Upstream Watersheds From 1963 Potomac River Report Located in State Planning Sub-region 19	54
4-8	Sub-region B, Potential Hydroelectric Power	56
4-9	A Tentative Program of Water Resources Development for 1980 State Planning Sub-region 1.	60
4-10	A Tentative Program of Water Resources Development for 1980, State Planning Sub-region 2	66
4-11	Elements of Component I	88
4-12	Elements of Component II	95
4-13	Elements of Component III	99
4-14	Implementation of the Plan	107
4-15	Costs, Benefits, and Indices	109

CHAPTER 4 - SHAPING THE PLAN FOR SUB-REGION B

LIST OF FIGURES

Figure No.	Title	Page II-4-
4-1	Population and Employment Projections	5
4-2	Planning Areas	7
4-3	Schematic of Water Needs and Alternative Solutions - New York State Planning Sub-region 1	61
4-4	Schematic of Water Needs and Alternative Solutions - New York State Planning Sub-region 2	67
4-5	Schematic of Water Needs and Alternative Solutions - Pennsylvania State Planning Sub-region 9	71
4-6	Schematic of Water Needs and Alternative Solutions - Pennsylvania State Planning Sub-region 8	75
4-7	Schematic of Water Needs and Alternative Solutions - Pennsylvania State Planning Sub-region 7	79
4-8	Schematic of Water Needs and Alternative Solutions - Maryland State Planning Sub-region 37, West Virginia State Planning Sub-region 19.	85
4-9	Plan of Development	111

LIST OF EXHIBITS

Exhibit No.	Title	Page
4-1	A Vacationscape for Appalachia	Bound after Page II-4-111

CHAPTER 4 - SHAPING THE PLAN FOR SUB-REGION B

SECTION I - FUTURE GROWTH PATTERNS

1. WATER SUB-REGION B

Other Studies in Progress

Water Sub-region B occupies a position of importance in the economies of New York, Pennsylvania, Maryland and the contiguous portion of West Virginia. Throughout the sub-region the impact of economic development in specific locations has often been limited to the closely adjacent areas because of topography and transportation networks.

Most of Sub-region B has recently been or is currently being investigated under comprehensive water resources studies.

The Delaware River Basin Comprehensive Survey, completed in 1960 and printed as House Document No. 522, 87th Congress, 2nd Session, presents a comprehensive plan for development and use of the water resources in the region drained by the Delaware River and its tributaries.

The Potomac River Basin Study was completed in 1963 by the Corps of Engineers, but was not submitted to Congress. In 1965, the Secretary of the Interior was directed by the President to review the Study and he set up the Interdepartmental Task Force on the Potomac for this purpose. The "Potomac Interim Report to the President" was submitted in 1966; two years later the Task Force issued its final report entitled "The Nation's Rivers". The report modified the recommendations of the 1963 Potomac River Basin Study. In 1969, the Chief of Engineers submitted his report to the Secretary of the Army for transmittal to Congress. This report incorporates the recommendations of the Task Force, modifying the 1963 Study recommendations.

The report on the Ohio River Basin Comprehensive Survey was furnished to the Water Resources Council in 1969. The basic objective of the Ohio basin study was to outline the characteristics of water and related land resource problems and general approaches that appeared most appropriate for their solution. The survey serves as a broad guide to the best use or combination of uses for water and related land resources of the Ohio River Basin to meet forseeable short and long-term needs.

The Susquehanna River Basin Study, conducted and coordinated through the Susquehanna River Basin Study Coordinating Committee, is scheduled for completion in 1970. The objective of the study is to determine all the present and near future water resource needs in the Basin and

formulate a development plan to meet these needs. The population and employment benchmarks used in the Appalachian Water Resources Survey are similar to the projections used in the Susquehanna Study.

The North Atlantic Division, Corps of Engineers, under the authority of the 1965 Omnibus Bill (PL 89-298), is conducting the North Atlantic Regional Water Resources Study (NAR) and the Northeastern United States Water Supply Study (NEWS). The areas under consideration in both reports include all of Sub-region B except that portion which lies within the Ohio River Basin. NAR is part of a nationwide program sponsored by the Water Resources Council which is investigating water resources to determine how they can be developed and managed to meet the long range needs of the study area. The scope of the investigation is comprehensive and multi-purpose, designed to provide a framework plan which will indicate needs and solutions in general terms through 2020. It will not carry through to the point of formulating specific projects, but will indicate those localities within the study area where urgent problems exist and will recommend that detailed studies of such problem areas be made at an early date.

The objective of the NEWS Study is to provide Federal assistance in preparing a plan to meet the long-range water supply needs of the urban northeastern United States. The plan may include major reservoirs and major facilities for conveyance and purification. Any project conceived and proposed for execution must be a suitable and pertinent part of the overall comprehensive general plan resulting from the NARS Study.

Two small areas in western Steuben County are part of the Genesse River Basin which has been studied under a joint federal-state comprehensive study. Non-federal studies are discussed in the state supplements.

Appalachian Water Resources Study

Two sets of economic projections were developed for Sub-region B in order to compare normal growth with growth accelerated by additional economic stimulation. The first set is a group of disaggregations developed by the Office of Business Economics based on employment projections derived from national population totals. In this work the Series B projections published by the Bureau of the Census in Projections of the Population of the United States by Age and Sex: 1964 to 1985 with Extensions to 2010 was utilized. Details of the derivation of the economic projections are given in Appendix E to the Main Report. The projections in this chapter and in Appendix E for the Susquehanna portion of Sub-region B were made by the National Planning Association. In general these data reflect the economic growth expected to occur in the water areas and sub-regions, based to a large extent on historical trends and shares of the national output.

The second set of projections, the benchmarks, are goals and planning guidelines. These benchmarks are the levels of population, employment, and per capita income which have been identified as reasonably attainable considering the potential of the area. Achievement of these benchmarks will fulfill Appalachian objectives.

The difference between these two sets of projections is the net economic expansion that must be stimulated by extraordinary investment - the type of investment envisioned by the Appalachian Act. However, these investments alone cannot do the job; rather their purpose is to pave the way for private investment that will provide additional permanent jobs, especially the high-wage permanent jobs that are so scarce in Appalachia today.

Normal and benchmark projections of population and employment for the water areas in Sub-region B are shown in Table 4-1 and Figure 4-1. The population and employment growth patterns are very similar. Water Areas B-2 and B-3 have benchmarks which are only modestly above the normal projections. In B-1, however, the benchmark is dramatically higher than the normal projection, surpassing Water Area B-2 in total population by a considerable margin. The premise underlying the rapid rise in population and employment benchmarks in B-1 is that this water area is already endowed with a stronger and more diversified economic base than is the case in Water Areas B-2 and B-3. Experience indicates that the greatest growth tends to occur around the largest existing population centers, and the greatest urban concentration is in Water Area B-1.

Analysis of both sets of projections indicates that employment would grow at a slightly faster rate than population in all three water areas, indicating a slight decline in the dependency ratios (total population divided by total employment). This assumes that out-migration will decrease, which, in turn, will have an effect on the population's age structure. Consequently, there will be a larger proportion of working age people remaining in the area. In addition, labor force participation rates increase with greater prosperity.

TABLE 4-1
POPULATION AND EMPLOYMENT
HISTORICAL AND PROJECTED WATER SUB-REGION B

	Years			
	1960	1980	2000	2020
B-1:				
Population	878,256	1,122,000	1,445,000	1,722,000
Employment	324,350	419,000	533,000	667,000
B-2:				
Population	1,048,803	1,304,000	1,590,000	2,119,000
Employment	353,115	451,000	571,000	761,000
B-3:				
Population	316,404	376,000	436,000	503,000
Employment	105,011	134,000	158,000	184,000
B: (TOTAL)				
Population	2,243,463	2,802,000	3,471,000	4,394,000
Employment	782,476	1,004,000	1,262,000	1,612,000

POPULATION AND EMPLOYMENT
DEVELOPMENTAL BENCHMARKS WATER SUB-REGION B

	Years		
	1980	2000	2020
B-1:			
Population	1,172,000	1,867,000	2,870,000
Employment	440,000	717,000	1,100,000
B-2:			
Population	1,312,000	1,649,000	2,253,000
Employment	461,000	648,000	884,000
B-3:			
Population	376,000	466,000	647,000
Employment	139,000	168,000	233,000
B: (TOTAL)			
Population	2,860,000	3,982,000	5,770,000
Employment	1,040,000	1,533,000	2,217,000

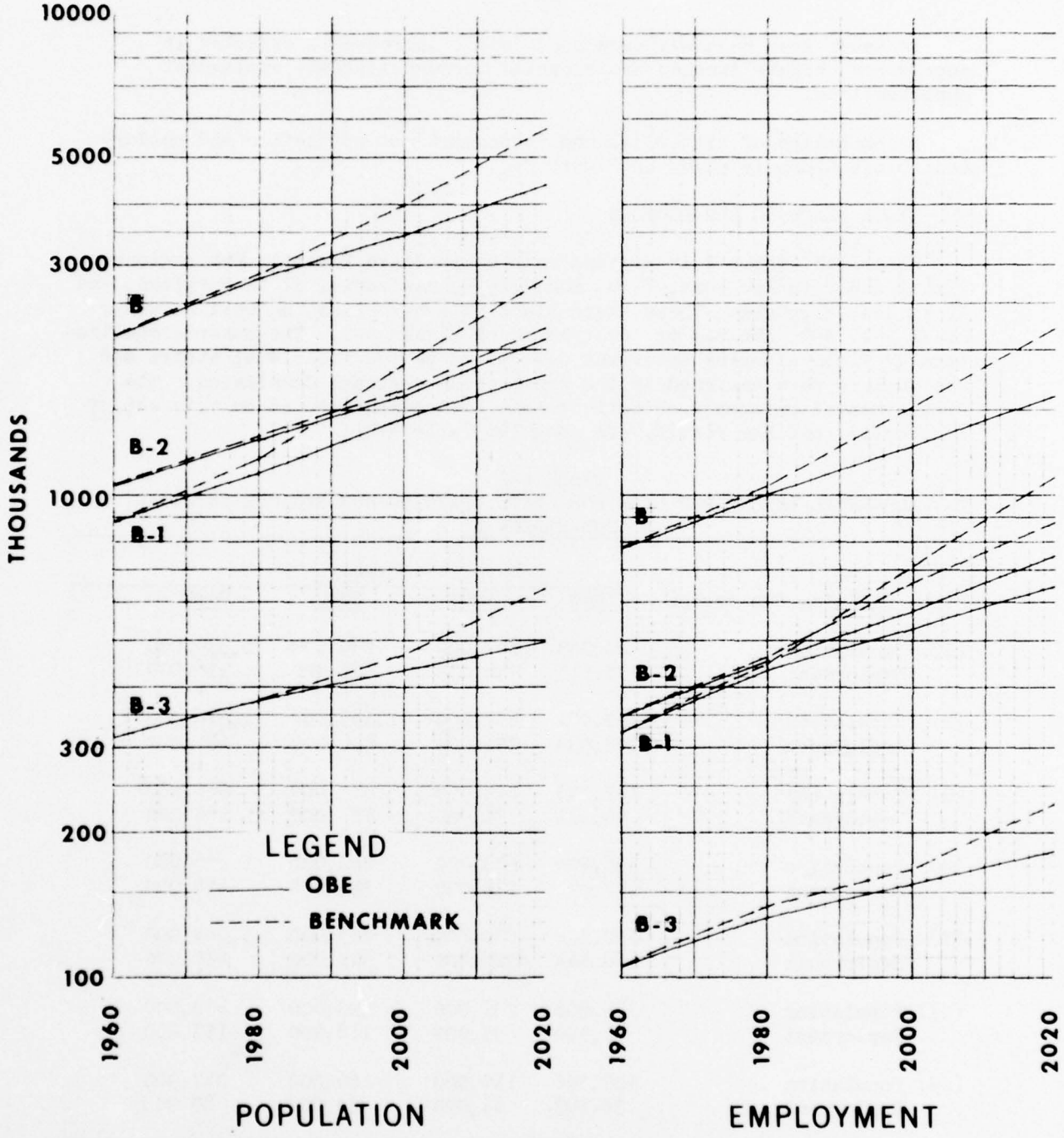


FIGURE 4-1

POPULATION AND EMPLOYMENT PROJECTIONS

In Water Area B-3, although no dramatic increase is expected in population, higher incomes are expected through improved employment opportunities.

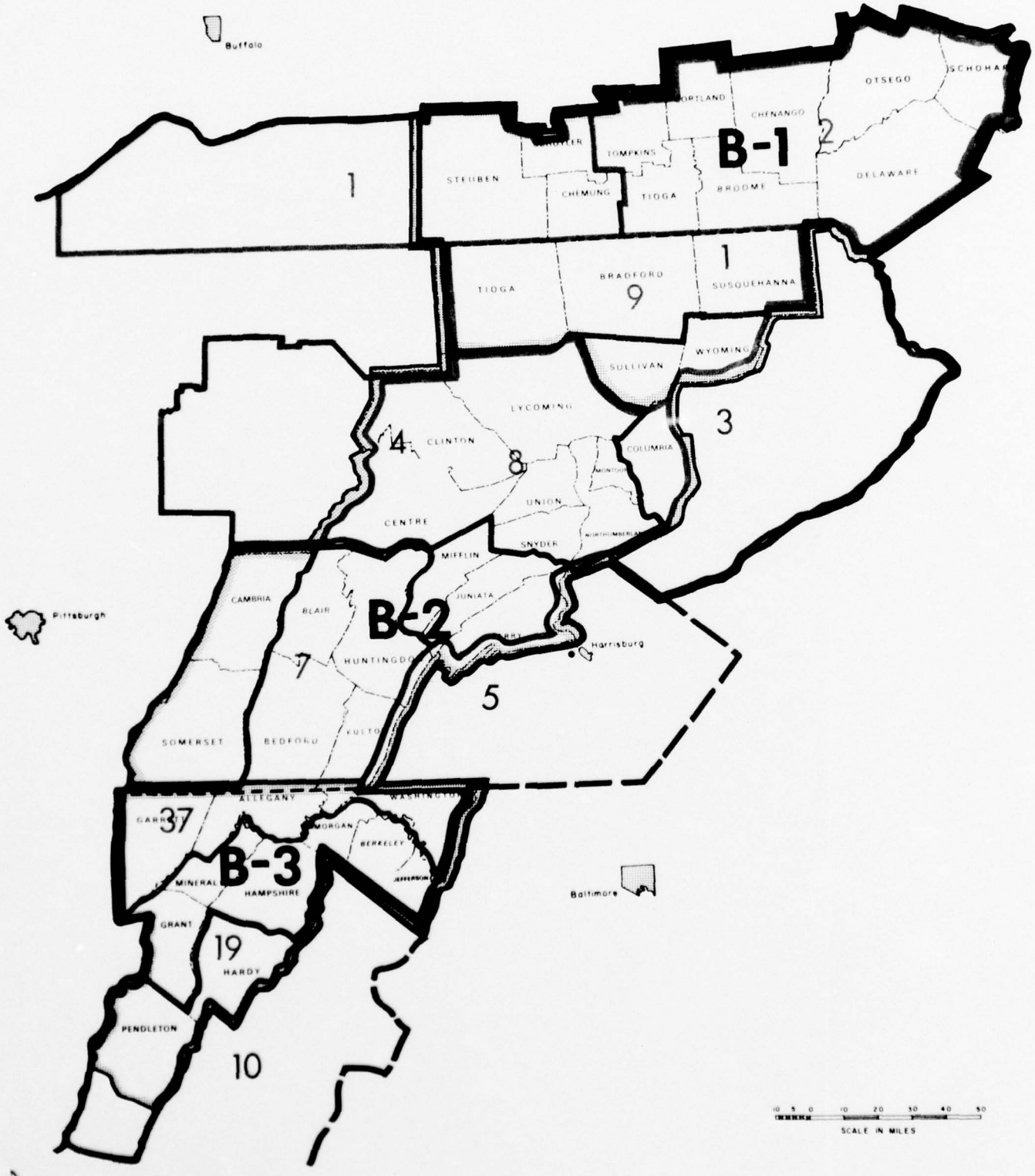
A comparison of historical and "benchmark" of population and employment projections is shown in Figure 4-1.

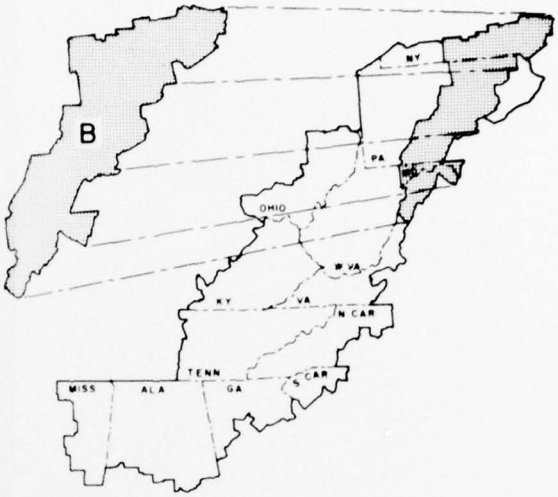
2. STATE PLANNING SUB-REGIONS

Water Sub-region B is divided into seven State Planning Sub-regions, with 1 and 2 in New York, 7, 8, and 9 in Pennsylvania, 37 in Maryland, and 19 in West Virginia. These state planning sub-regions, as well as Water Areas B-1, B-2, and B-3 are delineated on Figure 4-2. The sub-regionalization by state planning areas was determined by the individual states and the numbers were assigned by the Appalachian Regional Commission. The developmental benchmark objectives have been disaggregated on this set of boundaries, and the results are shown in Table 4-2.

TABLE 4-2
DEVELOPMENTAL BENCHMARKS DATA FOR STATE PLANNING SUB-REGIONS IN WATER SUB-REGION B

State Planning Sub-region		Years 1960	1980	2000	2020
(1)	Population	480,983	607,000	939,000	1,339,000
	Employment	173,515	244,000	362,000	516,000
(2)	Population	519,081	677,000	1,103,000	1,616,000
	Employment	198,039	251,000	415,000	650,000
(9)	Population	147,740	213,000	314,000	562,000
	Employment	50,511	75,000	124,000	185,000
(8)	Population	538,295	673,000	846,000	1,690,000
	Employment	192,671	236,000	333,000	454,000
(7)	Population	510,508	639,000	803,000	1,084,000
	Employment	160,444	225,000	315,000	430,000
(37)	Population	195,808	226,000	300,000	400,000
	Employment	66,509	95,000	118,000	153,000
(19)	Population	120,596	150,000	166,000	247,000
	Employment	38,502	44,000	50,000	80,000


Buffalo
B-1
1
2
STEUBEN
CHEMUNG
TIOGA
TOMPKINS
BROOME
CHENANGO
OTSEGO
DELAWARE
1
TIOGA
BRADFORD
9
SUSQUEHANNA
SULLIVAN
WYOMING
3
LYCOMING
4
CLINTON
8
COLUMBIA
UNION
CENTRE
SNYDER
MIFFLIN
JUNIATA
CAMBRIA
BLAIR
B-2
Harrisburg
7
HUNTINGDON
5
SOMERSET
BEDFORD
ALLEGANY
37
MORGAN
BERKELEY
B-3
MINERAL
HAMPSHIRE
Baltimore
GRANT
19
HARDY
PENDLETON
10
Pittsburgh
10 5 0 10 20 30 40 50
SCALE IN MILES



VICINITY MAP

LEGEND

- **APPALACHIAN REGION BOUNDARY**
- **WATER SUB-REGION B BOUNDARY**
- **B-1** **WATER SUB-AREA BOUNDARY**
- **3** **ECONOMIC SUB-REGION**
- **9** **STATE PLANNING SUB-REGION**

10 5 0 10 20 30 40 50
SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION B

PLANNING AREAS

OFFICE OF APPALACHIAN STUDIES AUGUST 1969

II-4-7 **FIGURE 4-2**

3. DEVELOPMENT CONSTRAINTS

One of the major constraints to development has been the disparity between the level of training and skills of the labor force and the requirements for the jobs available. Many of the people have migrated to areas of greater job opportunity. Farms have been getting larger with more mechanization and less manual labor required, creating a surplus of unskilled labor.

One of the greatest needs in Water Sub-region B will be for education and training facilities with curricula that are carefully coordinated with industrial development programs to meet local and regional demands for skills. Unless people are trained in skills which can be utilized in the area, the present out-migration will continue and growth will tend to remain on the normal projection curves.

More of the college educated people must be encouraged to remain in the sub-region. The recent graduates of the colleges and universities are more apt to be lured away from Appalachia, and yet these people are important to improvement in the leadership and productivity of the area. The most important step in retaining the trained population is to develop an economy that can support the kinds of employment and amenities that utilize the skills and talents of graduates.

4. PATTERN OF GROWTH ANTICIPATED

A certain level of economic stimulation, by means of strategic investment, is required to alter the trend of slow economic growth and attain the benchmark projections. These investments in the public and private sectors must be in addition to those which would normally occur. This added investment will act as a catalyst in raising the region's position within the national economy.

Water Area B-1

Ample developable open space in Water Area B-1 will allow for expansion to reach the 2020 benchmark level. Flood control and water quality improvement will be essential for industrial and recreational development throughout the area.

The New York portion is not apt to have trouble obtaining capital. Firms now locating in this area attest to the confidence of private investors. Additional public investment will be needed to make sure that present growth is not impeded, and to provide for increasing recreational demands. The planned highways of this portion were discussed in Sections 1 and 2 of Chapter 3. By the mid-1970's these roads should be completed; and, with the planned extension of air service facilities, this portion of the region will be well served.

The Pennsylvania portion of the region is relatively isolated and rural. With the emphasis on enhancement of recreational opportunities,

and improvement of an already good dairy farming economy, this area is expected to remain essentially rural. If recreation is to be developed on a large scale, provisions may have to be made for improved access in some cases.

Water Area B-2

If industrial development is to achieve a faster pace in Water Area B-2, improvement of transportation facilities, flood protection, water quality, and recreation opportunities is essential.

An important problem here is the damaged landscape left by the mining industry. A great amount of money will be required to solve the problems of acid mine drainage pollution and surface scars left by strip mining. More economical measures are needed to eliminate the pollution which is seriously reducing water quality in many streams and creating eyesores. Elimination of this problem will increase recreation, fishing, and hunting opportunities and provide additional water supply for industry and municipal growth.

Pennsylvania, Maryland, and West Virginia have legislation designed to minimize the adverse impact of mining activities. These states, the federal government and private enterprise are conducting research intended to improve preventive and abatement techniques.

Recognizing the fact that protection of its vitally important natural resources is one of the Commonwealth's most pressing problems, Pennsylvania's citizens approved a 500 million dollar Land and Water Conservation and Reclamation Program in 1967. This 10-year program will correct some of the ills inherited from the past and provide a base by which the Commonwealth's natural resources can be conserved and developed in a manner that will assure their continued use for future generations. These monies shall be allotted generally as follows:

> The Department of Mines and Mineral Industries is allotted $200 million for the elimination of land scars and water pollution created by past coal mining activities, of which $150 million is to be used for the prevention, control and elimination of stream pollution from mine drainage.
>
> The Department of Health is allotted $100 million to aid political subdivisions and municipal authorities in the construction, reconstruction and improvement of sewage treatment facilities.
>
> The Department of Forests and Waters, Fish and Game Commissions and the Historical and Museum Commissions are allotted a total of $125 million for the planning and development of public outdoor recreation areas, including lands acquired with Project 70 funds.

The Department of Community Affairs is allotted $75 million for State grants-in-aid to political subdivisions to pay up to fifty percent of the cost of the development of county and municipal parks, and recreation and open space lands.

Additional private capital is also needed in Water Area B-2 to build a greater diversity into the economy. A good start has been made in this direction. Pennsylvania has an excellent program to attract new industry, and it remains for more local communities to promote their own cause and make the most of State and Federal aid. In addition, this area provides good potential for recreational development. The formation of county-wide or multi-county associations is helping to attract tourists and mobilize private capital to build additional tourist facilities.

Water Area B-3

Water Area B-3 has a small economic base. The benchmarks show that the population should not grow a great deal, though a more prosperous existence can be realized for the people of the area. Cumberland and Hagerstown, Maryland and Martinsburg, West Virginia are all actively competing for new industry. The counties along the Potomac River will benefit from this growth and from recreation development proposed in the area. The smaller towns in Maryland and West Virginia could grow modestly, attract some appropriate light industry, and yet retain their pleasant rural atmosphere. This area also has considerable year-round tourist potential.

An inadequate transportation system is a problem in Area B-3. Even with completion of the planned road network, many towns will still be relatively isolated, and improvements of secondary roads will be required.

More than 50 percent of the families in the West Virginia counties of Pendleton, Grant, Hardy, and Hampshire are in the poverty class (less than $3000 annual income). Although subsistence costs are generally lower here than in other areas, there is a critical need to improve family income. Stimulus of economic activity in the larger communities within these counties would help relieve the problem.

Sub-Region B

The mineral industry in Sub-region B is not expected to play as important a role as an employer because of mechanization. The other mining industries should continue to grow, although they are only a small contributor to the regional economy.

Farms will continue to dwindle in numbers, while more efficient, larger operations become the rule. In addition, the total amount of land in agriculture should continue to decline. Because of these trends, the need for more capital outlays per farm and more highly skilled farm managers becomes apparent.

Forest industries can make substantial contributions to localized areas. However, the commercial forest resource is not approaching its capability. Additional inputs in the form of increased application of forest conservation practices and programs are needed. These programs integrated with increased research in forest products use technology and improved water-resource availability will enable the industry to contribute more effectively to the economic growth of the region.

Sub-region B has a water resource potential that is generally underdeveloped. Needs currently exist or are projected in the foreseeable future for flood control and management of flood plain land use; for improved municipal and industrial water supply and facilities; for improved water quality, especially for reduction of mine drainage pollution; flow augmentation for water quality improvement, fish and wildlife, recreation and aesthetics; and for all types of impoundments for water-based recreation. These major needs can be met economically and effectively by developmental measures such as reservoirs, groundwater well fields, waste treatment plants, and other structural measures, as well as through appropriate flood plain land use management. Programs and measures are also needed for improved land treatment and management, fish and wildlife protection, flood plain management, development of the area for scenic enjoyment and protection of areas of rare ecological or historical significance. The area has reservoir sites which could be utilized for hydropower development. Pumped storage development in association with mine mouth thermal generating plants could make economical power available.

In selecting and formulating projects and evaluating benefits, it was assumed that the greatest growth would take place in, and expansion would emanate from, existing urban centers. With the aid of state and county reports, approximately 150 central places were identified and, for purposes of this report, given the name "growth centers." These growth centers, in accordance with their economic interdependence, were organized into groups and called "growth complexes".*/ These have been discussed in Chapter 3, Section II, Socio Economic Structure, as part of the State planning sub-regions. The three complexes in Tioga, Bradford, and Susquehanna Counties, Pennsylvania, State Planning Sub-region 9, are of a different nature than the rest. This Northern Tier of Pennsylvania

---

*/ Listed in "Pennsylvania Water Supplement," Part V, Chapter 9, Main Report, as economic activity areas.

has great potential in recreational development, and these localities will receive considerable economic stimulation from recreation. The rest of the complexes throughout the sub-region are expected to receive relatively greater impetus through industrial and commerical growth, made possible, in large measure, by increased public investment under the Appalachian Act and related state programs.

SECTION II - WATER RELATED NEEDS

5. INTRODUCTION

The water resource developments required to stimulate and support added economic growth within Sub-region B include flood damage reduction, additional municipal and industrial water supply and distribution systems, improved overall stream quality, water-based recreation development, and land treatment measures. Although the existing and planned water resource projects discussed in Section I of Chapter 3 will satisfy part of the sub-region's total needs, additional water resource developments will be necessary if the benchmarks are to be met. It should be emphasized, however, that rarely is there an area where satisfying water resource needs alone will provide the potential economic growth. Development of water resources must be complemented by other investment programs if maximum growth potential is to be realized.

6. WATER RESOURCES NEEDS IN SUB-REGION B

The Problem in General

The relevant water and related land development needs to stimulate economic activity are primarily related to accelerating existing plans and programs for water resources development. Priority should be given to those projects which can do the most good in creating job opportunities and increasing incomes.

Flood Control

Flooding restricts use of land suitable for residential, commercial, industrial, and agricultural development. Although operation of existing flood control structures has materially reduced the flood damages in some portions of the sub-region, flooding is still a widespread problem. The sub-region contains some flood plain lands which, if provided with flood control and appropriate planning and management, would be excellent industrial sites whose development could provide the economic stimulus which the area so vitally needs. However, there are also many growth centers in the sub-region that have readily developable land not subject to flooding.

Flood damage to small upstream urban areas and agricultural lands is another recurrent problem in the sub-region. Upstream watershed projects and land treatment measures are necessary to reduce storm runoff and sediment, encourage better farming practices, and provide more intensive agricultural use of flood plain lands.

Average annual flood damages for all stream reaches in the sub-region total $27 million. These are residual damages, after the effect of flood control projects -- existing, under construction, or in the preconstruction planning stage -- are considered.

PRECEDING PAGE BLANK-NOT FILMED

In Water Area B-1, highest average annual flood damages accrue near the Growth Centers of Binghamton, Oneonta, Unadilla, Sidney, Cortland, Corning, and Painted Post, New York. Although some centers, such as Corning and Binghamton, have potentially developable land which is subjected to flooding, they also have suitable developable lands adequate for benchmark achievement outside the flood plain.

Flooding is a serious problem in much of Water Area B-2. Flood problems have been identified at Montoursville, South Williamsport, Williamsport, and Muncy in Lycoming County, Bloomsburg in Columbia County, Selinsgrove in Synder County, Marysville in Perry County, Meyersdale in Somerset County, Johnstown and Patton in Cambria County, Phillipsburg and Bellefonte in Centre County, Westfield and Knoxville in Tioga County, Williamsburg and Tyrone in Blair County, Lock Haven in Clinton County, Danville in Montour County, and Milton and Northumberland in Northumberland County. Of these communities, Lock Haven, Danville, Williamsport, Muncy, Milton, Northumberland and Bellefonte are identified as growth centers. Although there is developable land near Tyrone the downtown area is seriously affected by flooding. Accelerated construction of a local flood protection project planned for Tyrone would speed redevelopment and growth.

Flooding in Water Area B-3 occurs mainly along the North Branch and the South Branch Potomac Rivers at localities such as Cumberland, Luke, Maryland, and Keyser, Piedmont, Moorefield, and Petersburg, West Virginia. The Bloomington Reservoir, when completed, will prevent much of the flood damage now experienced along the North Branch Potomac River. The economy of Petersburg, West Virginia is inhibited by the flooding threat to ideally located industrial sites. Development of these sites would be an economic stimulus to the affected communities.

Many local and inter-regional planning groups have developed or are developing master plans which include land-use maps showing the best areas for residential, commercial, and industrial development. The majority of these communities, however, have no zoning regulations to deter undesired development and to provide for desirable orderly development. Zoning of land is a primary need in the sub-region to enable reasonable regulation of future development, particularly in the flood plain. Flood plain information studies are needed in many parts of Sub-region B.

Watershed Land Management

There is a growing need throughout the sub-region for planning and application of improved soil and water conservation practices. This need is currently being met by 38 organized soil conservation districts covering all the agricultural lands. The reduction of erosion and resulting stream sediments through land treatment and watershed developments will reduce local flood and sediment damages, increase productivity on affected upstream lands, and improve water quality through

sediment reduction. Land treatment and watershed development will help the limited agricultural lands meet future demands of the sub-region by improving agricultural production and farm income. Reclamation of strip-mined land and better erosion control during industrial, residential, and highway construction are also vital needs in the sub-region.

There is adequate suitable land available in the sub-region to satisfy the projected economy's need for agricultural development space. About 6.5 million acres of land are available in the sub-region. Projected needs for agricultural lands are shown in the following tabulation:

	1980	2000	2020
Cropland (Acres)	3,502,000	3,163,000	2,840,000
Pasture (Acres)	2,153,000	2,045,000	1,990,000

Although it is estimated that less acreage will be required for agricultural purposes in the future, it is anticipated that productivity will be considerably greater than is now being achieved. The increased productivity will result from more intensive use, improved farming practices, and greater use of fertilizers.

Some of the conservation needs for forest and woodland by 1980 include establishment or improvement of a timber stand on 5,975,200 acres, proper harvesting on 3,911,000 acres and protection of 1,086,400 acres from grazing by domestic livestock. As suggested by USDA Appendix A, to attain satisfactory watershed management on forest lands presently in public holdings, small private inholdings should be acquired by state, federal, or other governmental units where development and management will not otherwise be accomplished.

Streambank stabilization is needed to prevent loss of valuable flood plain lands from agricultural and other uses. The loss of such lands lowers water quality through sedimentation, degrades fishery habitat, reduces recreational and aesthetic values, and causes drainage problems.

Water Supply

Sub-region B receives abundant quantities of precipitation in an average year, but regulation of natural flows is needed to reduce damages during high runoff periods and to store water for use during the periods of low runoff.

Growth centers in the sub-region use both surface and ground water sources to satisfy municipal and industrial water needs in the approximate proportions listed:

	Surface	Ground Water
	%	%
Water Area B-1	50	50
Water Area B-2	85	15
Water Area B-3	90	10

To meet the projected benchmark development of the sub-region, municipal, industrial, and irrigation water supply needs have been estimated for all service areas. These estimated needs are shown in the following tabulation, in million gallons per day.

	1960	1980	2000	2020
B-1	152 mgd	250 mgd	470 mgd	910 mgd
B-2	223 mgd	455 mgd	780 mgd	1230 mgd
B-3	132 mgd	180 mgd	300 mgd	510 mgd

The dependable flow for the particular water service areas was determined and then compared with the demands. Centers having deficiencies of available streamflow are shown in Table 4-3. The deficiencies shown in the Susquehanna River Basin are for the years 1980, 2000, and 2020, and those in the Potomac River Basin are for the years 1985 and 2010. These are the additional quantities required through development of surface or ground water sources assuming full use of the available dependable streamflow.

TABLE 4-3
ADDITIONAL NEEDS FOR WATER SUPPLY
AND WATER QUALITY IMPROVEMENTS

Water Area	Growth Center	Water Supply (cfs)			Water Quality (cfs)		
		1980 (1985)*	2000 (2010)*	2020	1980 (1985)*	2000 (2010)*	2020
1	Bath, N.Y.			10			10
	Elmira, N.Y.	10	100	200	40	125	375
	Cortland, N.Y.		15	35	10	40	130
	Binghamton, N.Y.		75	175		110	480
	Sidney, N.Y.			13			29
	Corning, N.Y.					10	61
	Ithaca, N.Y.	3.6		15.1			
	Hornell, N.Y.	2	3.3	6.6	6.6	10	13.3
2	Lock Haven, Pa.				125	290	430
	State College, Pa.	10	20	40	40	85	140
	Tyrone, Pa.				60	80	140
	Altoona, Pa.	30	50	75	25	55	110
	Williamsburg, Pa.		10	20	150	240	430
	Roaring Springs, Pa.			10	100	170	245
	Wellsboro, Pa.			10	10	15	20
3	Keyser, W.Va.	125*	100*	-	-	-	-
	Hagerstown, Md.	-	-	-	-	-	-
	Martinsburg, W.Va.	-	-	-	-	-	-

*/ Potomac Basin

In Water Area B-1, principal sources are the Susquehanna River and wells. Water supply deficiencies will appear at Elmira and Ithaca, New York by 1990. By the year 2000, significant deficiencies will be evident, without further source development, at both Elmira and Binghamton. In addition, near the turn of the century, smaller deficiencies will occur at Cortland, Sidney, Hamilton, Norwich, Hornell, and Bath, New York, and in smaller communities and rural areas.

Water supply deficiencies will occur in Water Area B-2 at State College and Altoona, Pennsylvania around 1980. Lock Haven is expected to have a rather severe problem by the year 2000. Bald Eagle Creek is the source of water supply at Lock Haven rather than the West Branch Susquehanna River, which is polluted by acid mine drainage. Additional water supply will also be needed in the rural areas.

In Water Area B-3, the Luke-Keyser area is expected to have a water supply deficiency due primarily to the need for industrial cooling water. The Bloomington Reservoir Project, currently in preconstruction planning, will satisfy estimated streamflow requirements in the North Branch Valley through the year 1990. Increased water supply demands are expected at Cumberland, Maryland and Martinsburg, West Virginia, but studies of the two areas indicate sufficient quantities of water are available from the nearby Potomac River.

One of the most pressing needs in the rural areas of the sub-region is adequate public water supplies to support increasing populations and per capita use rates. Very little industrial expansion can be expected in the rural areas without additional dependable water supplies. Demands for municipal and industrial water in rural areas can generally be supplied by wells and small storage structures.

Irrigation in Sub-region B is expected to increase in the future but water for such purposes is not likely to become a critical problem. Water applied per irrigated acre in the sub-region averages less than 12 inches annually. Rivers, smaller streams, wells, and small impoundments are the main sources of supply. Water for the relatively small acreages of irrigated land can usually be supplied by private means.

Maintenance of Stream Quality

Many reaches of streams in Sub-region B presently have water quality problems. Economic development and population growth will increase the quantities of municipal and industrial wastes substantially above current levels. Table 4-4 shows the waste loadings which can be anticipated if development occurs as projected by the benchmarks.

TABLE 4-4
UNTREATED WASTE LOADINGS (P.E.* IN 1,000's)
ACCRUING FROM BENCHMARK GOALS

Water Area	1960	1980	2000	2020
B-1	641	1400	2700	5050
B-2	2685	3700	5650	9800
B-3	641	717	1130	1900

* Population Equivalent.

Municipal and industrial wastes, mine drainage, and sedimentation have been problems in the sub-region's streams for many years. Industrial effluents and an excessive load of organic materials are primary pollutants. Excessive nutrients from treated wastes and from agricultural fertilizers are other factors which reduce the quality of the sub-region's water resource. Construction of new sewage treatment plants, which will control the levels of nutrients such as nitrogen and phosphorus, is needed. Controlling land use and runoff would reduce sediment and nutrient loads and materially contribute to improved water qualtiy.

Locations which require increased streamflow for satisfactory water quality are shown in Table 4-3. In estimating the requirements, it was assumed that growth of public sewage and waste treatment systems would parallel the growth of public water supply facilities, and that these systems would collect and treat nearly all wastes generated by the year 2020. Preliminary estimates were developed for the minimum streamflow required on a month-by-month basis, after secondary waste treatment at the source, to maintain a quality level consistent with state standards.

The pollution that results from mine drainage creates a problem in many of the streams of Sub-region B that is of equal importance to, and in some cases may be of greater importance than, the biological contamination that results from inadequate waste disposal systems in the cities of these water areas. Solution of this problem is considered essential for improvement of the economic welfare of the Commonwealth of Pennsylvania and must be accomplished in order to attract new industries and a greater share of the recreation and tourist trade. Pollution by mine drainage occurs in the Tioga River watershed, on the upper West Branch Susquehanna River, above Curwensville on Chest and Clearfield Creeks (both right bank tributaries of this stream), on the Bennett Branch Sinnamahoning Creek, on Babb Creek (the left bank tributary of Pine Creek on the Frankstown Branch Juniata River, and on Shamokin, Mahanoy, and Mahantango Creeks (left bank tributaries of the Susquehanna River). Mine drainage problems also exist on the Casselman River and its

tributaries and the Conemaugh River and its tributaries in Somerset and North Branch of the Potomac upstream from Luke, Maryland is degraded by mine drainage pollution.

Binghamton, Cortland, Bath, Ithaca, and Elmira, New York, located in Water Area B-1, will experience significant deficiencies in water quality in the future. The 20 mile reach below Binghamton is one of the most degraded portions of the entire Susquehanna River. Other centers that expect to have quality problems by 2020 are Sidney, Norwich, Hornell and Corning, New York. Pollution associated with excessive nutrient loadings is a problem in the natural inland lakes, especially Cayuga and Seneca Lakes. Generally, however, water quality will be good in this water area if adequate treatment of wastes at the source is provided together with selected acid mine drainage pollution abatement. There is no storage in existing reservoirs allocated to water quality control in Water Area B-1. Flow augmentation would help improve the general quality and aesthetics in many streams.

In Water Area B-2, pollution problems from municipal and industrial wastes occur in North Bald Eagle Creek, West Branch Susquehanna River, in the vicinity of Lock Haven and Milton, Pennsylvania. Planning for adequate waste treatment at Lock Haven will be necessary to prevent serious downstream degradation.

In Water Area B-3, Hagerstown, Maryland and Martinsburg, West Virginia will have significant water quality problems due to inadequate waste treatment along Antietam and Opequon Creeks, respectively. Moorefield and Berkeley Springs, West Virginia are expected to develop water quality problems during the period being studied. The acid condition of the North Branch Potomac River is also a major problem. Pollution problems associated with industrial wastes occur at Luke and Cumberland, Maryland. Bloomington Reservoir will increase flows alleviating organic water quality problems, but the effect on the acid problem may be negligible since the stream flowing into the reservoir carries these mine drainage waters. This problem is under detailed study in conjunction with detailed planning for the Bloomington Reservoir Project.

Degradation of stream habitat is the primary limiting factor to development of the full fishing potential of the sub-region. From the fishery resource standpoint, the most troublesome sources of water pollution are drainage from abandoned underground coal mines and runoff from strip-mined areas. The major streams most adversely affected are the West Branch Susquehanna River and some of its larger tributaries above Lock Haven, Pennsylvania, the North Branch Potomac River above Luke, Maryland, the upper Casselman River, and the Conemaugh River. If mine drainage pollution of the major streams could be alleviated, a significant and valuable fishery and outdoor recreation resource would be restored to the sub-region.

Navigation

Studies of current and future potential river traffic on the Appalachian portion of the Susquehanna and Potomac Rivers, have not resulted in favorable conclusions concerning the need to develop inland waterways in the Appalachian portion of these basins.

Waterbound commercial navigation was significant to the area of Sub-region B during the nineteenth century, providing transportation for commodities such as furs, flour, farm produce, coal, and timber. A system of canals was developed in the area which linked the frontier beyond the Alleghenies with tidewater markets. The Erie Canal joined Lake Erie with the Hudson River at Albany, thus providing a water course from the Great Lakes to New York City. Other canals connected the Chemung and Chenango Rivers with the Erie Canal. Commercial use of the canal system helped village outposts such as Detroit and Cleveland become growing cities and produced a vast communications system which connected New York City with mid-western lands. The Pennsylvania Canal provided a waterway from Columbia on the Susquehanna River to Hollidaysburg on the Juniata. The last loaded barge navigated the Chesapeake and Ohio Canal from Cumberland, Maryland to Washington, D.C., in 1924. Loss of traffic to more modern rail and highway transportation equipment caused the abandonment of this and other canal routes as commercial waterways.

Power

Electric power requirements in the Appalachian Region will increase rapidly. Fossil fuel is abundant in the region and has been determined by the Federal Power Commission as sufficient to meet the electric power supply requirements beyond the year 2020. The FPC, in Appendix B of the Appalachian Report, has determined electric power requirements for each of the 15 power supply areas wholly or partially in the Appalachian Region. Portions of power supply areas 3, 5, and 7 are within Sub-region B.

Future power supply will be both imported to and exported from the Appalachian Region. The major demand will be met with fossil fuel and nuclear steam electric generating facilities. Nevertheless, this relatively mountainous area of the eastern United States provides a large potential for pumped storage development and some potential for conventional and combined conventional-pumped storage development.

The region has a transmission network capable of carrying large blocks of power. Only a few small areas are not located near adequate transmission lines.

Recreation, Hunting and Fishing

The Bureau of Outdoor Recreation has made estimates of the probable demand for four basic water related outdoor activities --

boating, swimming, picnicking, and camping. The results of their studies are contained in Appendix F of this report. Fish and wildlife needs as defined by the Bureau of Sport Fisheries and Wildlife for each water area are tabulated in Appendix G. Outdoor recreation needs were converted to recreation days, disaggregated by water area on the basis of population, and combined with fish and wildlife needs to arrive at a total estimated requirement for water related recreation days by water area. The results are shown in Table 4-5.

TABLE 4-5
TOTAL RECREATION NEEDS* IN WATER SUB-REGION B
(MILLIONS OF RECREATION DAYS)

Water Area	1980	2000	2020
B-1	9.6	29.1	78.3
B-2	9.8	31.1	81.9
B-3	3.8	11.7	40.0
Total B	23.2	71.9	200.2

* Includes fish and wildlife.

A surplus of 0.8 million recreation days for fishing is indicated for Water Area B-1 in 1980 and 0.3 million for the New York portion of B-1 in 2000. Deficiencies in recreation activities, excluding fishing, are indicated in each water area of Sub-region B by 1980. An additional 97,000 acres of water will be required to satisfy the demand for water related recreation in the sub-region by 1980. To meet ultimate needs, access to more well managed lands and waters must be available to the public.

Although the recreation needs for Sub-region B appear large when compared to the population of the region, the proximity to the large centers of population have been considered. The interstate highways, coupled with the Appalachian Corridors make access from New York City, Philadelphia, Baltimore, Washington, Delaware, Pittsburgh, and Cleveland easy. There is a big demand by these cities for vacation type recreation facilities, as well as for the day use facilities.

In Water Area B-1, considerable development of recreation facilities will be required to satisfy future needs. Total estimated recreation needs (including fishing and hunting) for the water area will be 9.8, 30.0, and 76.5 million recreation-days by 1980, 2000, and 2020, respectively.

Total recreation needs for the Water Area B-2 will be 9.9, 32.0, and 80.0 million recreation-days by 1980, 2000, and 2020, respectively. This water area includes a large complex at Prince Gallitzin State Park being developed by the Commonwealth of Pennsylvania in Cambria County, Pennsylvania. A large Federal-State recreation complex is also being planned in conjunction with the Raystown Reservoir Project.

Water Area B-3 includes the Spruce Knob-Seneca Rocks National Recreation Area in West Virginia. The U.S. Forest Service is developing a plan for this recreation area, which has, at present, very little slack water. Recreation needs in Water Area B-3 will be 3.9, 12.1, and 39.1 million recreation-days by 1980, 2000, and 2020, respectively. This water area, although deficient in water-based recreation facilities has considerable developmental potential. Deep Creek Lake in Garrett County, Maryland and Mount Storm Reservoir in Grant County, West Virginia are the only large bodies of water in the water area, and the primary purpose of the latter is for cooling water. They will be augmented by construction of Bloomington Reservoir on the North Branch Potomac River.

7. WATER RESOURCES NEEDS BY GROWTH COMPLEXES AND STATE PLANNING SUB-REGIONS

Water resource development needs in Sub-region B are primarily associated with the demands for water supply, water quality, flood control, and recreation relating to the growth centers and surrounding areas. With the exception of recreation, the broad water needs previously discussed for water areas are further disaggregated and discussed by state planning sub-regions. It should be noted that the needs of growth centers are not restricted to the named communities, but include the affected hinterlands.

State Planning Sub-region 1 - New York

Major water related needs are apparent in the Chemung River Valley growth complex at Elmira, Corning, and Painted Post. Water supply, and especially water quality problems, will produce growth constraints at Elmira. Additional sources for water supply will be needed for Elmira by 1980, and Corning by 2000. Hornell, center of the Hornell-Alfred growth complex, and Bath, located in the Cohocton River Valley complex, are expected to incur water supply and water quality problems.

The Chemung River between Painted Post and Elmira, and the Cohocton River below Bath, have experienced flood control problems. However, most of the damages in the Chemung River will be reduced by the construction of the Cowanesque and Tioga-Hammond Reservoirs. The Arkport and Almond Reservoirs and local protection projects at Hornell have provided adequate flood protection. Rural flood damages occur on the Canisteo River below Addison.

Based on the Bureau of Outdoor Recreation's estimate, water-oriented recreation needs in excess of present capacity for this area are estimated at 1,600,000 recreation days annually in 1980 and will increase to 6,300,000 in 2020.

Surface water requirement for irrigation has been estimated by the U.S. Department of Agriculture to be 2000 acre-feet in 1980, 4100 acre-feet in 2000, and 4600 acre-feet in 2020. More than 90 percent of the irrigation need is in the Chemung and Tioga River Basins.

State Planning Sub-region 2 - New York

Flooding problems are experienced along the Susquehanna River in the communities of Oneonta, Unadilla, and Sidney, which compose the Susquehanna Valley growth complex. It is anticipated that Sidney will also develop deficiencies in water supply and that water quality problems will occur by the turn of the century.

Norwich in the Chenango Valley complex is expected to incur a water supply problem by 2020. Water quality may also become a problem in the Chenango River, near Norwich, by 2020. Flood damages have occurred in the southwest part of Norwich as the result of flooding in the lower reach of Canasawacta Creek. Ice jams at the confluence of Canasawacta Creek and the Chenango River add to the flood problem.

Cortland in the Ithaca-Cortland complex currently experiences flooding from the Tioughnioga River and is expected to develop water supply needs by 2000. The city will develop water quality improvement needs on the Tioughnioga River if anticipated growth occurs. However, flooding is not considered a growth restraint since developable lands are available outside the flood plain and growth is taking place on these higher lands.

Flood problems exist at Ithaca, near Cayuga Lake, and Watkins Glen, at the head of Seneca Lake. However, damages are minor and are not considered a growth restraint. The recently completed Ithaca Cayuga Inlet local protection project would prevent an estimated $2,568,000 damages during recurrence of the maximum flood of record. Additional or improved water supply sources are needed for both Ithaca and Watkins Glen.

Water supply, water quality improvement and additional flood protection are needed in the Binghamton-Owego-Susquehanna growth complex. Water requirements in the metropolitan Binghamton area are projected to increase to over six times the present consumption rate by 2020. To assure an acceptable standard of water quality, assuming waste loads receive secondary treatment, flow augmentation will be required. An existing local flood protection project at Binghamton provides a degree of flood protection to the community but some land, ideal for industrial and commercial development, is subject to flooding. A flood plain information study has been prepared for Binghamton which includes reaches of the Susquehanna and Chenango Rivers.

Delhi, New York is not considered a growth center although a foundation for economic activity exists in the community. This village, along with others, is one of the service centers in the complex. The central business district and adjacent developable lands are susceptible to flooding, and this condition is considered a constraint to growth.

In the Cobleskill-Schoharie growth center, there are no water resource development needs identified. Regional board studies are needed to identify and plan for meeting water needs.

The demand for recreation facilities will continue to increase in State Planning Sub-region 2. More leisure time will create demands for more water based recreation areas. The net unsatisfied demands (needs) are projected to increase to over 20 times the present unsatisfied demands (in recreation days) by 2020. Additional water surface requirements are also projected to increase from about 3000 acres to 13,000 acres in 2020.

Little supplemental irrigation is practiced in this area. The U. S. Department of Agriculture has estimated the present annual agricultural water use at 8,000 acre-feet and expects it to increase to about 31,000 acre-feet in 2020. It is further estimated that the surface water requirement to meet these irrigation needs will be about 6,000 acre-feet in 1980, 14,000 acre-feet in 2000, and 17,000 acre-feet in 2020. These needs are above those that are expected to be met from ground water sources.

State Planning Sub-region 9 - Pennsylvania

There are few major water problems within this State Planning Sub-region which relate to growth centers located in the Commonwealth of Pennsylvania. This sub-region is, however, located immediately south of the Corning-Elmira-Binghamton growth area in New York state, and accordingly, affects, and is affected by this growth center. The Tioga River flows north out of Sub-region 9 in Pennsylvania and makes its confluence with the Chemung River near Corning, New York. The Chemung River flows southeastward to its confluence with the Susquehanna at a point immediately northwest of Sayre, Pennsylvania. In this instance, both states are concerned with pollution originating in the adjacent state. Water polluted by mine drainage, which may also have an adverse impact upon recreation plans of northern Pennsylvania, is carried by the Tioga River into New York State and waters polluted by the inadequate waste treatment from the industrial centers in New York State flow southward into Pennsylvania. Many communities in State Planning Sub-region 9 have very poor water supply systems. Small communities across the countryside, and residential, commercial, and industrial users are supplied by individual wells and springs. The eastern and western portions of this sub-region have little economic influence, but the Elmira-Binghamton growth centers in New York employ

commuters. Pollution of the major streams is now a deterrent to future development. Since this is an area underlain by glacial gravel, both surface water and ground water tables are easily contaminated. Since communities in the area are small, they are generally unable to finance sewage disposal systems.

State Planning Sub-region 8 - Pennsylvania

The economy of the State College growth center is oriented toward the Pennsylvania State University and commercial and industrial activity partially dependent upon that institution. The population expansion and accompanying development have exceeded the capacity of the present water supply system. The problem is expected to worsen if projected development occurs. It is anticipated that growth will also produce water quality problem in the future.

The Lock Haven growth center is susceptible to flooding from West Branch Susquehanna River and Bald Eagle Creek and experiences water pollution from both mine drainage and municipal and industrial wastes. The community is expected to develop a water supply shortage by 1980. A flood plain information report is being prepared for Lock Haven, covering the flood plains of both West Branch Susquehanna River and Bald Eagle Creek.

The town of Muncy in the Williamsport growth complex experiences flooding from Muncy Creek and from backwaters of the Susquehanna River. A flood plain information study has been prepared for Williamsport and includes reaches of West Branch Susquehanna River, Lycoming, and Loyalsock Creeks.

Bloomsburg, Danville, Milton and Northumberland are susceptible to stream overflow of various magnitudes. Flooding at Northumberland is relatively minor and does not pose a constraint to growth since developable lands are available outside the flood plain. The flood problem in the other three communities is of more serious proportions. A high priority has been established for securing a flood plain information study of the Susquehanna River, Fishing Creek, and Little Fishing Creek in the vicinity of Bloomsburg. Milton, on the main stem of the Susquehanna River, was included in the 1966 Flood Insurance Study. The state has made extensive studies of the flood situation at Danville. Levees have been constructed along the Susquehanna River, work is currently under construction on Mahoning Creek, and a project on Sechler Run has been recommended in the State Supplement. The project is currently in a deferred status due to lack of funds for construction. All of these communities have, or soon will have water supply and waste treatment problems. There is also a need for more water oriented recreation opportunities in the sub-region.

State Planning Sub-region 7 - Pennsylvania

A local flood control project at Johnstown, on the Conemaugh River, provides that growth center with a degree of protection, but residual flooding offers a development constraint.

It is anticipated that the Altoona growth center will experience a water supply deficiency by 1980 and will develop a water quality problem if the projected growth occurs.

lthough Tyrone is not considered a growth center, the community suffers economic restraint because of periodic flooding of the downtown commercial center. Tyrone is expected to experience municipal and industrial water supply shortage by 1980. A water quality problem will develop as projected development occurs.

State Planning Sub-region 37 - Maryland

Maryland State Planning Sub-region 37 is comprised of Garrett, Allegany, and Washington Counties, and lies along the North Branch of the Potomac River, the river forming the southern boundary. This reach of the North Branch has long been polluted with municipal, mine, and industrial wastes. The municipal water supply system serves a population of about 80,000 persons. Many of the industrial activities have self supply systems. It is estimated that the water requirement for municipal and industrial purposes will be 221 mgd by 1985 and 475 mgd by 2010.

The growth centers included in this sub-region are Cumberland and Hagerstown, Maryland. The city of Cumberland will share in the water supply needs listed above. Cumberland and Hagerstown both have flood problems: Cumberland from the North Branch Potomac River and Hagerstown from Antietam Creek. Water quality improvement may become a need on Antietam Creek as Hagerstown continues to grow.

The community of Luke, Maryland also has needs for increased water supply. Since it is a part of the Keyser, West Virginia growth complex, its problem will be discussed along with those of Keyser.

State Planning Sub-region 19 - West Virginia

The Keyser, West Virginia - Luke, Maryland growth center is subject to flooding from the North Branch of the Potomac River. Water supply needs for this growth center are shown in Table 4-3, and are primarily for industrial processes. The municipal, mine drainage, and industrial waste pollution in the Potomac River presents a water quality problem at Keyser-Luke.

The Martinsburg growth center is expected to experience a municipal and industrial water supply shortage by 1980. Opequon Creek may develop unsatisfactory water quality as development progresses.

The secondary growth centers at Petersburg, Piedmont, and Moorefield are affected by flooding. The economy of Petersburg is inhibited by the flooding threat to prime industrial sites which, if developed, would provide an economic stimulus.

Other Needs of Sub-region B

Although the preceding paragraphs have mentioned the problem of mine drainage pollution in the streams of this sub-region, the full extent has not been described. Plate 5 of Appendix C shows the streams colored red that are thus polluted. Generally speaking, this pollution affects the West Branch Susquehanna River, the Tioga River, the Youghiogheny River, the Casselman River, and the upper portion of the North Branch of the Potomac River. This pollution destroys most of the aquatic life, seriously damages the aesthetic values, and, while it does not prevent the use of the water for municipal and industrial purposes, increases the treatment costs.

Conservation treatment needs for the agricultural lands of Sub-region B have been categorized and are shown in Table 4-6. A more complete discussion of these land treatment and conservation needs is contained in Appendix A.

TABLE 4-6
CONSERVATION TREATMENT NEEDS FOR AGRICULTURAL LANDS

Type	Area (acre)
Cropland	1,989,400
Pastureland	1,156,500
Forest and Woodland	11,005,600
Other	192,800

SECTION III - ALTERNATIVES FOR MEETING NEEDS

8. STRUCTURAL

An array of structural alternatives from Federal, state and private water resource development opportunities were considered in determining potential solutions to satisfy water related needs in Sub-region B. Alternatives which were evaluated as structural measures for flood control include reservoir storage, flood walls, levees, channel improvements and combinations of these. Surface and ground water sources were considered as means of providing water supply demands. Improvement of water quality could be achieved by low flow augmentation, advanced waste treatment, reclamation of strip mined areas, sealing shaft mines, and diversion of polluted flows. Water quality requirements, as determined for this study, assume that secondary treatment of wastes will be provided. Water oriented recreational opportunities could be provided by reservoirs and streams.

9. NON-STRUCTURAL

An active program of flood plain information studies, flood plain zoning and management policies, evacuation, and flood forecasting services are considered non-structural alternatives to prevent increases in future flood damages by holding damage potential, as near as possible, to its present level. Such programs should accompany any structural flood control plan. Alert action based on sound hydrologic and hydraulic studies can guide the development potential, minimize the unwitting encroachment into areas of high risk flooding hazards, and promote wise land use policies.

Non-structural means of minimizing water supply and quality problems are important components of any effective water management plan. The combined Federal and state programs for establishing and controlling water quality standards will contribute to the wise use of this resource. Technological improvements in treatment systems, in reuse or closed cycle process as in industrial plants, and other applications, promise gains for both quantity and quality problems.

Those rivers which have been designated as wild, scenic, or recreational due to their remarkable scenic, geologic, historic, cultural, recreational, fish and wildlife or other such qualities and which will be preserved in a free-flowing condition are considered as non-structural alternatives for satisfying some recreational demands.

10. APPLICATION OF ALTERNATIVES

Relevant structural and non-structural alternatives considered in satisfying the water resource needs of Sub-region B are discussed in the following paragraphs by State Planning Sub-regions.

State Planning Sub-region 1 - New York (See Figure 4-3, page 61.)

The portion of New York State Planning Sub-region 1 that is within Water Sub-region B consists of three counties -- Steuben, Schuyler, and Chemung. These counties are in the watersheds of the Chemung River and its tributaries, and of the Finger Lakes -- Keuka and Seneca. The planning sub-region has three identified growth centers, the Elmira-Chemung Valley, Cohocton Valley-Hammondsport, and Hornell-Alfred. Probable solutions to the primary problem in these growth centers is discussed in the following paragraph.

Hornell-Alfred Growth Center

Future water supply needs and possible alternatives for meeting these needs are currently being evaluated in a comprehensive study of the Susquehanna River Basin. Preliminary findings of this study indicate that the surface water source for Hornell is now being used to near capacity. Ground water storage in the area can be developed, and when added to the existing source, will meet the needs through 2020. If the ground water storage should prove to be inadequate, other probable sources would be: reallocation of storage in Arkport and Almond Reservoirs, located on the Canisteo River and on the right bank tributary, Canacadea Creek, respectively; or revision of the Marsh Ditch upstream watershed project to include a water supply impoundment.

Municipal and industrial wastes are expected to precipitate water quality problems in the Hornell-Canisteo area as development occurs. Flow augmentation in the amounts of 8 cfs are anticipated by 1980, 13 cfs by 2000, and 19 cfs by 2020. Flow augmentation from reallocated storage in the existing Almond and Arkport projects, pumping from ground water, and advanced waste treatment are appraised as means of managing water quality. Secondary treatment facilities must first be added.

Bath (Cohocton Valley-Hammondsport Growth Center)

The community of Bath is presently served by an underground water supply source which should meet the demand until after the turn of the century, but could experience a minor water supply shortage of 7 mgd by 2020. A water quality need of 1 cfs is expected to occur by 2000 and increase by 10 cfs by 2020. Possible solutions to satisfy water supply needs include development of additional ground water sources and potential impoundments on Mud, Five Mile, Twelve Mile, and Campbell Creeks. Augmented flows from these sources could be used to alleviate the water quality problem. This need could also be satisfied with advanced treatment measures.

Upper Five Mile Creek, an authorized upstream watershed development, includes channel improvement and land treatment measures which would reduce flood damages and provide more productive acreages for agricultural use in Steuben County.

Corning-Elmira (Elmira-Chemung Growth Center)

Although local flood protection projects exist at Painted Post and Corning, additional protection for these communities would provide supplemental lands for more productive uses. Reductions of flood stages could be provided from storage in potential reservoirs on Mud and Five Mile Creeks. The authorized Tioga-Hammond and Cowanesque Reservoir projects, currently in advanced planning, will provide reductions of 8.8 feet from the flood of record at Corning and Painted Post and 7.1 feet at the downstream growth center of Elmira.

It is expected that Corning will experience water quality needs from municipal and industrial wastes, and if treated by dilution would require additional flow in the amounts of 11 cfs by 2000 and 61 cfs by 2020. The existing water supply source should be adequate until the turn of the century but a shortage of 3 mgd may occur by 2020. Solutions to water quality and quantity problems include development of ground water sources and use of potential impoundments on Mud and Five Mile Creeks.

Other alternatives are the allocation of storage in the Cowanesque and Tioga-Hammond Reservoirs for these purposes. The Susquehanna Comprehensive Study is considering a storage reallocation for Cowanesque Reservoir.

Water supply deficiencies will develop at Elmira by 1980 and, without additional supply development, will amount to about 145 mgd by 2020. Alternative solutions to this water need include development of ground water sources and use of storage in Cowanesque and Tioga-Hammond Reservoirs, Mud Creek and Five Mile Reservoirs, upstream watershed developments, or a combination of these. Elmira is expected to experience serious water quality problems in the near future. If treated by dilution, additional flow of 58 cfs would be required by 1980, 182 cfs by 2000, and 373 cfs by 2020. Advanced waste treatment and flow augmentation from ground water sources or Tioga-Hammond, Cowanesque and potential Mud Creek and Five Mile Creek Reservoirs are possible measures for improvement of stream quality.

An upstream watershed development, Newtown-Hoffman Creek, has been investigated by USDA and has been determined a feasible project. The development, near Elmira, would include two structures and provide 1,192 acre-feet of flood control storage, 150 acre-feet for municipal and industrial water supply, and a recreation pool of 100 acres.

Mud Creek and Five Mile Creek Reservoirs, upland reservoirs investigated by SCS and New York State, in-stream impoundments (low dams), and other streamside recreation developments are considered possible measures to provide water-oriented recreation opportunities for this area, particularly for the growth areas of Hornell, Bath, Corning, and Elmira.

State Planning Sub-region 2 - New York (See Figure 4-4, page 67.)

New York State Planning Sub-region 2 is comprised of a seven county area which includes Tompkins, Cortland, Chenango, Otsego, Tioga, Broome, and Delaware Counties. Five counties of the planning sub-region are drained by the Susquehanna River and its tributaries. However, most of Tomkins County drains into the Finger lakes, Cayuga and Owasco, and most of Delaware County drains into the Delaware River and its tributaries. There are four designated growth centers in this sub-region; namely, Susquehanna Valley, Chenango Valley, Ithaca-Cortland, and Binghamton-Owego-Susquehanna growth complexes.

Susquehanna Valley Growth Complex. (Oneonta, Unadilla, and Sidney)

Flooding problems are experienced along the Susquehanna River in the communities of Oneonta, Unadilla, and Sidney with average annual damages amounting to about $108,000, $82,000 and $75,000, respectively. (January, 1966 price level.)

Construction of the authorized Davenport Center, (an element of the Charlotte Creek Complex), West Oneonta, or Copes Corner Reservoirs, or potential reservoirs such as East Guilford, Mount Upton, or Middlefield Reservoirs would reduce flood damages in the Upper Susquehanna Basin in this planning sub-region, and would provide flood protection for the above communities as well as the Binghamton-Endicott-Johnson City area and along the main stem of the Susquehanna River in Pennsylvania.

These reservoirs would also provide water oriented recreation opportunities for this area. Since Interstate 88 from Albany to Binghamton will be constructed in the next 5 years, recreation pressure in this area is expected to be very high. From the New York State supplemental study, a new potential site T-2, located at the head of the Davenport Center Reservoir, has been identified as an excellent site for general recreation. A combination of Davenport Center and T-2 as a reservoir complex has been considered in the Susquehanna Study to satisfy needs for flood control and recreation for the area and for water supply and water quality for the downstream communities. The State has also studied site, T-1, which is considered an alternative to the Davenport Center site. It is located about 2 miles upstream of the Davenport Center site. The U.S. Department of Agriculture has investigated development of the Mill Brook Creek upstream watershed, and tentative results indicate a project of two structures would provide 403 acre-feet for flood control storage and 530 acre-feet for recreation in Chenango County. Measures considered to reduce flood damages include local protection projects and upstream watershed developments.

Sidney should experience a water supply shortage of 13 cfs and need for water quality improvement by 2020. If the water quality improvement is achieved by dilution, about 26 cfs is needed. Ground water and

impoundments on Charlotte, Otego and Butternut Creeks, as well as potential upstream watershed developments, are alternate measures to provide water supply and low flow augmentation. Advanced waste treatment is also an alternative for water quality improvement.

Chenango Valley Growth Complex

A water supply deficiency of about 6 cfs is expected for Norwich by 2020. Possible solutions for meeting this need include development of ground water sources, upstream watershed projects, and allocation of storage in the authorized South Plymouth Reservoir on Canasawacta Creek.

The South Plymouth Reservoir would also provide adequate flood protection along the lower reach of Canasawacta Creek in the southwest part of Norwich and along the Chenango River below Norwich. The site also would provide recreational opportunities for the area. An authorized reservoir site on Genegantslet Creek is an alternative to the South Plymouth site.

An authorized upstream watershed project on Genegantslet Creek includes 5 miles of channel improvement and two structures which would provide 480 acre-feet for flood control storage.

Ithaca-Cortland Growth Complex

The Cortland area derives its water supply from existing wells which are estimated to have a maximum yield of 10 mgd, which should be adequate for the near future. However, the estimated needs for municipal and industrial water supply are expected to reach 26 mgd by the year 2000 and 46 mgd by 2020. These needs could be met by developing additional ground water sources or from impoundments in potential upstream watershed projects on the west branch of Tioughnioga Creek and on Cheningo Creek, or a combination of these sources. Ithaca's water supply deficiencies can be met by impoundments on Fall and Virgil Creeks. These projects could also provide recreation.

The growth complex could experience a significant water quality problem from municipal and industrial waste. If dilution is required, deficiencies of flow would be 10 cfs by 1980, 65 cfs by 2000, and 126 cfs by 2020. Alternative methods of providing this need include low flow augmentation by pumping from ground water sources, or impoundments in the above mentioned upstream watershed projects, and advanced waste treatment.

The two upstream watershed projects will provide flood protection for Cortland and along the Tioughnioga River, and recreational opportunities for the area. A low dam on the Tioughnioga River between Cortland and Marathon is also considered a possible measure to provide recreational opportunities. Local protection projects are alternative solutions for flood protection for both Cortland and Marathon.

A potential upstream watershed project on Cayuga Inlet would include seven structures to provide 14,500 acre-feet of flood water storage and reduce damages to residential and commercial improvements and agricultural lands in the vicinity of Ithaca.

Binghamton-Owego-Susquehanna Growth Center

A system of levees, flood walls, and channel improvements at Binghamton comprise a local protection project designed to protect that community against the flood of record and provide reductions in discharge equivalent to 63 percent of the standard project flood on the Chenango River and 43 percent on the Susquehanna River. Residual damages are experienced on potentially developable land, average annual damages amounting to about $230,000. Solutions to the flood problem at Binghamton include storage in the authorized Davenport Center Reservoir project or alternative developments on Charlotte Creek, authorized South Plymouth and Genegantslet Reservoirs, potential impoundments on the Unadilla River, development of upstream watershed projects, or extension of the local protection project.

The USDA has three authorized upstream watershed projects in the vicinity of Binghamton which would provide some reduction of flood flows and sediment control in the tributaries of the Susquehanna River. Although these streams enter the Susquehanna downstream from Binghamton, their watersheds contain urban and rural areas contiguous to the growth center. The Nanticoke Creek project in Broome and Tioga Counties includes 5.6 miles of channel improvement and 11 structures which provide 5,904 acre-feet for flood water storage and 794 acre-feet for sediment. The Patterson, Brixius, Grey Creeks watershed development includes one structure which provides 904 acre-feet for flood control storage and 56 acre-feet for sediment. The Little Choconut, Finch Hollow, and Trout Brook watersheds include seven structures which provide 2,379 acre-feet of flood water storage and 473 acre-feet for sediment.

Without further development, a water supply shortage of 52 mgd is expected by 2000 at Binghamton and 169 mgd by 2020. Solutions investigated to meet this need include ground water, storage in potential impoundments on the Unadilla River or in authorized South Plymouth, Genegantslet, and Davenport Center Reservoir, or alternative impoundments on Charlotte Creek.

Water quality problems will become significant at Binghamton by the turn of the century. Dilution requirements of 140 cfs are anticipated by 2000 and 481 cfs by 2020. An alternative to dilution would be advanced waste treatment at the pollution source. Flow augmentation could be achieved by pumping from ground water, or by release from storage in East Guilford, South Plymouth, Genegantslet, and Davenport Center Reservoir or alternative impoundments on Charlotte Creek.

Other Areas

Delhi, New York, is the County Seat of Delaware County. Although this community is not considered a growth center, it has a built-in economic base in the jobs, payrolls, and business activities associated with county government. It was once a commercial hub functioning as a processing center for the surrounding dairy farms. Advanced technology in transportation of milk and constraints such as serious traffic movement problems, strung out business district, available labor force, and stream overflow have combined to lower the economic status of the town to an undesirable level. Stimulation by increased interest of the county government and vigorous local leadership is beginning to precipitate economic activity in the area. The community experiences flood damages from overbank flow and ice jams. A local protection project for Delhi would make flood-free land available for further development of the central business district and make possible an urban renewal program in areas now subject to inundation. Other measures which were considered to provide flood control include upstream watershed developments, channel improvement, levees, flood walls, filling low areas, or a combination of these.

The Appalachian Highlands Recreation study recommended further investigation of the Delhi-Otsego-Cooperstown State Park Complex as a means to satisfy some of the sub-region's recreation demand. The area involved is located in Otsego, Delaware, and Schoharie Counties. The complex would include Gilbert, Glimmerglass, and Otsego State Parks; Cooperstown Baseball Hall of Fame; and six ski areas. By combining these attractions the complex would offer year-round recreation opportunities.

State Planning Sub-region 9 - Pennsylvania (See Figure 4-5, page 71.)

Flood damages to the urban and rural lands and lack of water supply in the rural areas are problems. Local development groups in Tioga and Susquehanna Counties, together with the Soil Conservation Service, have completed investigations for upstream watershed projects in Tioga, Susquehanna, and Bradford Counties. These projects and their status are shown below:

Project	County	Status
Mill Creek	Tioga	Authorized
Marsh Creek	Tioga	Authorized
Cory Creek	Tioga	Complete
Bentley Creek	Bradford-Chemung (NY)	Planned
Martin Creek	Susquehanna	Authorized

Information concerning purposes considered, storage allocations, water surface areas, etc., are shown in Tables XXVI-A and XXVII-A of Appendix A.

The five counties comprising this state planning sub-region, designated by the Commonwealth of Pennsylvania as the Northern Tier Development District, lie in one of the few large land areas in the northeastern United States which has remained sparsely populated while being almost completely surrounded by large rapidly growing metropolitan areas. The mountains, streams, forests, and overall scenic beauty provide excellent potential for creating new jobs and attracting people and recreation oriented industries into the area. A comprehensive outdoor recreation study entitled "Vacationscape for Appalachia" includes State Planning Sub-region 9.*/ Projects considered in the study to meet recreation demands include the authorized Tioga-Hammond and Cowanesque Reservoirs in Tioga County and single purpose recreation reservoirs on Tunkhannock Creek in Wyoming County and Mill Creek, approximately 12 miles west of Towanda in Bradford County.

The Appalachian Highlands Recreation Study, made by the Appalachian Regional Commission, recommends that the Susquehanna-North Tier Complex be further considered as a recreational development alternative. The area encompassed by the complex would include portions of Tioga, Bradford, Sullivan and Wyoming Counties, and would include Tioga-Hammond Reservoir, Colton Point, Leonard Harrison, Hill Creek, and Worlds End State Parks, and 14 supporting recreation areas.

Pine Creek from Ansonia to Waterville is being studied as an addition to the National Wild and Scenic River system. About half of this reach is in Tioga County and is considered as a portion of the recreation opportunities in this planning sub-region.

A large number of potential impoundments are being considered in the Susquehanna River Comprehensive Survey Report. Although the development plan for this sub-region has not yet been completed, the potential projects designated by stream name, from which the plan to be recommended will be derived, are listed below. The potential projects are grouped by time of need 1980, 2000, and 2020. Purposes for which the projects are being considered are shown.

---

*/ See Exhibit 1, bound at end of this chapter.

Potential Project	Purpose
1980	
Asaph Run	F,R,LF
L. Br. Asaph Run	F,R,LF
Babb Cr.	F,R
Bellman Run	FC
Tioga River	FC
Johnson Cr.	FC
Upper Tioga Cr.	F,R
Sugar Cr.	FC,F,R
Fall Cr.	FC,R
Parks Cr.	F,R
Little Loyalsock Cr.	FC,R
Loyalsock Cr.	F,R
Buttermilk Cr.	F,R
Tunkhannock Cr.	F
Dundaff Cr.	R,FC
2000	
Elkhorn Cr.	R,F
Elk Run	R,F
Fall Cr.	FC
Bently Cr. Trib.	FC
Buck Cr.	FC
Bently Cr.	FC
S. Br. Trib., Towanda Cr.	FC,F,R
N. Br. Wyalusing Cr.	R,F
Pettis Cr.	F,R
Bowman Cr. Trib.	R,F
2020	
Mill Cr.	R,F
Rumerfield Cr.	F
Tuscarora Cr. Trib.	F
Tunkhannock Cr.	R,F
Mitchell Cr.	F

F-Fishing
R-Recreation
FC-Flood Control
LF-Low Flow Augmentation

The headwaters of the Tioga River are contaminated by acid mine drainage, which extends about 20 miles downstream before it becomes diluted and neutralized by tributary inflow. The importance of providing for abatement of acid flows in the Tioga River is important because of the development of the authorized Tioga-Hammond Reservoir, and is a high priority item in the state's development plan. Acid flow into the reservoir would adversely affect the project's recreation potential. Possible solutions to the mine drainage pollution include filling, sealing, and grouting upstream mines which produce acid materials, diversion channels, and drainage control and treatment.

State Planning Sub-region 8 - Pennsylvania (See Figure 4-6, page 75.)

Pennsylvania State Planning Sub-region 8 consists of the following 11 counties: Clinton, Lycoming, Columbia, Montour, Union, Northumberland, Snyder, Centre, Mifflin, Juniata, and Perry. In this 11-county area are four growth complexes, or centers: State College, Lock Haven, Williamsport, Danville, and Sunbury-Milton. Water resources problems and developmental needs are discussed in the following paragraphs.

State College Growth Complex

The State College area currently obtains its water supply from three wells and a small reservoir. The combined sources have a dependable yield of 0.3 mgd during severe droughts and a yield of 1.3 mgd during periods of above normal rainfall. Current water supply requirements indicate a deficiency of 3 mgd. Population projections and estimated total municipal and industrial water requirements indicate the need for an additional 9 mgd in 1980, 18 mgd in 2000, and 27 mgd by 2020. Possible means of satisfying the water supply needs include developing a well field near the borough, a pipeline from Foster Joseph Sayers Reservoir, or developing water supply impoundments on Bald Eagle Creek. Pumping will be required for all alternatives.

State College has a water quality problem from sewage and industrial wastes. Solutions to this problem include advanced waste treatment and/or augmented flows by pumping from ground water sources or water transported from Foster Joseph Sayers Reservoir.

Lock Haven Growth Complex

Foster Joseph Sayers Reservoir, now under construction by the Corps of Engineers, will reduce flooding by Bald Eagle Creek at Lock Haven. However, the average annual residual flood damages at Lock Haven amount to $611,000 dollars, and could be reduced by a local protection project consisting of levees, flood walls, and/or channel improvement. Nonstructural measures which could help prevent the increase of future flood damage include implementation of a flood plain management program to be derived in studies now in progress.

The city of Lock Haven utilizes Bald Eagle Creek, a number of reservoirs on tributary streams, and a well for water supply. If this city and the surrounding area continue to grow as rapidly as expected, the present water supply system will become inadequate before the year 2000. It will be necessary to increase the present supply by about 36 mgd by the year 2000 and about 60 mgd by the year 2020. If investigations show that the flow of Bald Eagle Creek will not supply these additional requirements, other alternatives would be the development of ground water or pumping water from the West Branch Susquehanna River. Water quality problems exist on both Bald Eagle Creek and the West Branch Susquehanna River in this vicinity. Bald Eagle Creek is polluted by both municipal and industrial wastes, while the West Branch Susquehanna River is polluted by mine drainage. Alternatives for alleviation of the pollution problem of Bald Eagle Creek are a higher degree of treatment of both municipal and industrial wastes or flow augmentation from either ground water sources or releases from storage in the Foster Joseph Sayers Reservoir located upstream. If this pollution problem is to be relieved by dilution, it is estimated that about 99 cfs additional flow will be required in 1980, about 300 cfs in the year 2000, and about 430 cfs by the year 2020. For dilution flow to be furnished by Foster Joseph Sayers Reservoir, a reallocation of storage would be required.

Williamsport Growth Complex

The State of Pennsylvania considers Muncy to be a community with a major flood problem, indicating that 40 percent of the buildings have been flooded in the past. The problem is caused by overbank flow from Muncy Creek, a tributary of the Susquehanna River. Average annual flood damages for the community amount to $304,000, considering stage reductions with Foster Joseph Sayers Reservoir in operation. Alternative means of providing flood protection for Muncy include levees, flood walls, channel improvement, or impoundments on the Susquehanna and tributaries. Nonstructural alternatives which are considered as measures to prevent increases in future flood damage include a flood plain information report and implementation of a flood plain management program.

Sunbury-Milton Growth Complex

A snagging and clearing project by the Corps of Engineers was completed at Milton in 1951. The project consisted of clearing the channel of the West Branch Susquehanna River to improve flow conditions. Residual flood damages with an average annual value of $201,000 will remain after Blanchard Reservoir is completed. Solutions considered to reduce flood damages at Milton include a local protection project and upstream impoundments. Implementation of a flood plain management program would prevent an increase in flood damages by keeping damages, as near as possible, to the present level through programs designed to plan wise use of flood plain lands.

Bloomsburg, considered by the State to have a serious flood problem, experiences average annual flood damages of $118,000. Potential measures to alleviate the problem include a local flood protection project and upstream watershed development. Development of impoundments on Fishing Creek and its tributaries would provide a measure of flood protection. A flood plain information report, a management program for flood plain lands, evacuation, and flood forecasting services are considered as measures to prevent an increase in future flood damages.

Danville is classified by the State of Pennsylvania as a community with a serious flood problem. Average annual flood damages amount to $395,000. Solutions considered to provide protection for Danville consist of levees, flood walls, and channel improvement. Pennsylvania has a flood control project under construction at Danville, Mahoning Creek and additional protection is needed along Sechlers Run. Nonstructural measures which would prevent an increase of future flood damages include a flood plain information report followed by implementation of a flood plain management program and provision of flood forecasting services.

Two USDA authorized upstream watershed projects present alternatives to meeting some water related needs in this growth complex. A development on Briar Creek, a tributary of the Susquehanna River, upstream from Bloomsburg, would consist of three structures which provide 1,073 acre-feet of storage for flood waters, 199 acre-feet for sediment, and a total water surface of 138 acres for recreation on two of the reservoirs. The majority of flood control benefits from this project would accrue to residential and commercial improvements, in and near the community of Berwick.

The Middle Creek watershed development in Mifflin, Snyder, and Union Counties would include three structures and produce 8,895 acre-feet of flood control storage, 770 acre-feet for sediment, 56 acre-feet for municipal and industrial water supply, and a total recreation water surface of 230 acres for two reservoirs.

Other Problems

The West Branch Susquehanna River is affected by acid mine drainage through Clinton County to a point just downstream from Lock Haven, where alkaline flows from Bald Eagle Creek neutralizes the acid. Below this juncture, the stream is generally alkaline, but subject to occasional slugs of acid from upstream runoff. Probable considerations for abatement of acid mine drainage in the West Branch include backfilling, sealing, grouting, and reclamation of headwater strip mine areas, drainage flow control, diversion channels, and treatment. The Pennsylvania State Supplement lists acid abatement in the upper West Branch as a high priority item.

Large reservoirs and upstream watershed developments offer possible solutions to the demand for water related recreation opportunities. Blanchard Reservoir, currently under construction on Bald

Eagle Creek, and potential low dams on the West Branch Susquehanna River near Williamsport, on the Juniata River near Lewistown, on the Juniata River near Thompsontown, and on the main stem near Millersburg would produce large water recreation areas. Potential upstream watershed developments are being investigated in the Susquehanna River Basin Study to provide surface area for water oriented recreation. Projects of this type include Big Run, a tributary to Beech Creek in Clinton County, Pine Creek in Centre County, Larry's Creek and tributaries to Roaring and Catawissa Creeks in Columbia County, Turtle Creek in Union County, tributaries to Jacks Creek in Mifflin County, George and Mahantango Creeks, tributaries to Tuscarora Creek in Juniata County, and Little Juniata Creek in Perry County.

Centre, Clinton, and Lycoming Counties are located in the study area for the "Vacationscape." Potential reservoir developments under that investigation consist of three sites in Lycoming County, one on Muncy Creek, another on Little Muncy Creek near Moreland, and a small reservoir on Beaver Run. Blanchard Reservoir is also considered as an element of the "Vacationscape."

Pine Creek has been designated as a possible addition to the National Wild and Scenic River System from Ansonia in Tioga County to Waterville near the confluence with Little Pine Creek.

A tabulation of the improvements that are being considered in the Susquehanna River Basin Study that lie within State Planning Subregion 8 follows, grouped by time of probable need.

Potential Project	Purposes
1980	
SW. Br., Big Run	F,R
Larry's Cr.	F,R
Mill Cr.	R,F
Big Run	F,R
Little Muncy Cr.	F,R
Green Cr. and Mud Run	F,R
Brier Cr.	WL
Beaver Run	FC,F,R
Roaring Cr., Trib.	FC,R
Lick Run	FC
Mugser Run	FC,F,R
Turtle Cr.	F,R
W. Br., Chillisquaque Cr.	F,R
Williamsport, LD	R
Lewistown, LD	R
Lock Haven, LPP	
Bloomsburg, LPP	
2000	
E. Br., Big Run	F,R
Six Mile Run	F,R
Muncy Cr.	F,R
Shamokin Cr., Trib.	F,R
Dougherty Run	F,R
Thompsontown, LD	R
2020	
Laurel Run	I
Pine Cr.	FC,R
Cocolarmus Cr.	F,R
Sherman Cr.	R
Huntington Cr.	F,R
Little Muncy Cr.	F
Joe Gray Run	F
Wallis R., Trib.	F,R
Millersburg, LD	R

LD-Low Dam
F-Fishing
R-Recreation, FC-Flood Control
WL-Wildlife, I-Irrigation

State Planning Sub-region 7 - Pennsylvania (See Figure 4-7, page 79.)

Pennsylvania State Planning Sub-region 7 is comprised of six counties: Cambria, Blair, Huntingdon, Somerset, Bedford, and Fulton. The southern portions of Bedford and Fulton Counties are drained by tributaries of the Potomac River, the southeastern portion of Somerset County is in the Potomac River drainage, while the remainder of the County is drained by tributaries of the Allegheny and Monongahela Rivers. Southern Cambria County drains into the Allegheny River. The remaining counties of the planning sub-region are in the Susquehanna River Basin. Altoona is the only designated growth center in this planning sub-region. However, there are several small communities that have problems that are significant.

Altoona Growth Center

The Altoona area is served by both private and public water supply systems which obtain water from surface storage. The Blair Gap Water Supply Company uses reservoirs located on Blair Run, Tipton Run, Bells Gap Run, and Kettle Creek as their sources of supply. The company averages an output of about 5 mgd. The Municipal Water Works obtains water from reservoirs located on Mill Run, Homer Gap Run, and Burgoon Run. These reservoirs have a yield of about 7.5 mgd which, added to the 5 mgd of the privately owned company, provides a total of 12.5 mgd. Projected population and accompanying municipal and industrial water supply needs indicate that the Altoona area will require additional water for municipal and industrial purposes amounting to 8 mgd by 1980, 20 mgd by 2000 and 35 mgd by 2020. Alternative measures considered to meet the future water supply requirements are development of ground water well fields, pipelining water from the Raystown Reservoir which is currently under construction by the Corps of Engineers on Raystown Branch of Juniata River, and transporting water from a potential reservoir on Spruce Creek in Huntingdon County. The possibility of developing water supply storage on the Frankstown Branch of the Juniata River should also be considered.

The municipal and industrial wastes of this growth center are discharged into both the Little Juniata River and the Frankstown Branch Juniata River. Although secondary treatment is provided, a quality problem now exists in both streams and, as the population and industrial activity increases, this condition will grow worse. Improvement could be achieved by either a higher degree of waste treatment, or by dilution. Dilution water could be obtained by pumping from ground water storage.

The Naturealm Conservation and Education Area currently being developed by the Commonwealth of Pennsylvania in the Prince Gallitzin State Park presents a recreational and educational development that is expected to attract a large number of visitors.

The Appalachian Highlands Recreation Study proposed further detailed studies on two terminal complexes within this state planning

area. The Raystown-State Park Complex would include Raystown Reservoir and state parks at Greenwood Furnace, Whipple Dam, Blue Knob, and Cowans Gap, supported by 11 contiguous recreation areas. The Raystown complex is located principally in Huntingdon County but includes portions of Mifflin and Juniata Counties in State Planning Sub-region 8. Deep Creek-Youghiogheny-Casselman-Laurel Mountains Interstate Complex is located within 25 miles of the confluence of the Youghiogheny and Casselman Rivers and offers diverse recreation opportunities, featuring water resources and winter skiing. The complex is comprised of Deep Creek Lake, Youghiogheny Reservoir, Casselman River Recreation Area, and the Laurel Mountains Area, each supported by additional recreation areas.

Other Problem Areas

Tyrone, located in Blair County, on the Little Juniata River, experiences serious flooding in the downtown area. Although potential developable lands not subject to inundation are available near Tyrone, the community's economic stimulus will depend on flood protection of the established commercial center in the downtown area. Potential solutions to the flood problem at Tyrone include levee, flood walls, channel improvement, diversion, or a combination of these measures. The Corps of Engineers has an authorized local protection project at Tyrone which would protect the community against discharges greater than the maximum flood of record.

Municipal and industrial demands for water supply at Tyrone currently exceed the source by about 5 mgd, and this deficiency is expected to reach 9 mgd by 1980, 12 mgd by 2000, and 19 mgd by 2020. These shortages can be met from ground water sources or upstream watershed development.

Tyrone will develop a small water quality deficiency by 1980. Solutions include advanced waste treatment and low flow augmentation from ground water sources or upstream watershed projects.

To meet the needs of flood control and water supply in rural areas and water oriented recreation for the water area, consideration will be given to potential upstream watershed developments on Stony Creek in Cambria and Somerset Counties and Wills Creek in Bedford and Somerset Counties. The Stony Creek development would include five structures to provide 19,490 acre-feet of storage for flood prevention, and three of these reservoirs would produce a total of 870 acres of water surface for recreation. This project is recommended in the Pennsylvania State Supplement. The Wills Creek project would consist of four structures, providing 8,555 acre-feet of flood water storage and 500 acre-feet for municipal and industrial water supply. One reservoir would provide 440 acres of recreation pool. Additional potential watershed developments to be considered as alternative measures for providing recreation needs include North Branch Little Aughwick Creek in Huntingdon County, Sideling Hill Creek in Fulton County, and Shaffer Creek in Bedford County. Raystown Reservoir, on the Raystown Branch of the Juniata River, will be

completed by 1980. This reservoir will provide flood control, water quality control, and recreation.

A tabulation of potential projects that are being considered in the Susquehanna River Comprehensive Survey Report Studies follows, grouped by time of probable need.

Potential Project	Purpose
1980	
Beaver Dam Run	R R
Sideling Cr.	F,R
Shaffer Cr.	F,R
2000	
George Creek	F,R
2020	
Great Trough Creek	R
Clear Creek	F,R
Chest Creek	F,R,WS

F-Fishing
R-Recreation
WS-Water Supply

The southern portion of Cambria County and the western portion of Somerset County are drained by headwater tributaries of the Monongahela and Allegheny Rivers. These streams are the Conemaugh, Youghiogheny, and Casselman Rivers. Johnstown, located in Cambria County, and Meyersdale, in Somerset County, have flood problems. The Conemaugh River is severely polluted by mine drainage. These problems and their resolution are discussed in Chapter 12 (Sub-region F) of this report.

State Planning Sub-region 37 - Maryland (See Figure 4-8, page 85.)

Maryland Planning Sub-region 37 is comprised of Garrett, Allegany, and Washington Counties. All of the sub-region, except the western portion of Garrett County, which drains into the Ohio River Basin, is in the Potomac River watershed.

Cumberland Growth Center

It is estimated that municipal and industrial water supply needs for Cumberland and the other communities dependent on it will require additional water supply of 10 mgd by 1980, 22 mgd by 2000, and 32 mgd by

2020. Alternatives for meeting these needs are expansion and enlargement of present supply from Evitts Creek or the Potomac River, or from storage developed in watershed improvements on Mills Creek (SCS), or on Town Creek (pumping would be required). The Potomac River is polluted by both municipal and industrial wastes and by mine drainage in the reach above the mouth of the Savage River. The Bloomington Reservoir, now in advanced engineering and design stage, will provide 92,000 acre-feet of storage for augmentation of flow. A potential site on the Savage River upstream from the existing Savage Reservoir could provide an additional 39,000 acre-feet. Upstream watershed projects above Bloomington, George's Creek, New Creek, Mills Creek, and Patterson Creek would provide little regulation for quality improvement.

An existing local protection project at Cumberland in conjunction with operation of Bloomington Reservoir will result in substantial reductions of flood damage; however, it is estimated that the community would have a residual average annual flood damage amounting to $610,500. Extension of the existing local protection project and flood reductions afforded by the upstream watershed developments, which are being considered on George's, New, and Mills Creeks, would reduce this residual. The three watershed projects would provide about 23,000 acre-feet of flood detention storage. The New Creek project is now authorized. Non-structural measures should also be considered as a means of preventing further increases in flood damages. These would include flood plain management programs which might include zoning, flood warning arrangements, evacuation plans, and flood proofing.

Luke, Maryland, a part of the Luke, Maryland-Keyser, West Virginia growth area, will have residual average annual flood damages of $522,000 after construction of Bloomington Reservoir. Since the flood problem results from the North Potomac River, a levee or floodwall would probably be required to eliminate these flood losses. Upstream watershed improvements in the North Branch of the Potomac River above Bloomington Reservoir and on George's Creek, would provide some regulation of flow. Some regulation is now provided by Savage Reservoir, located on the Savage River, by spillway surcharge storage. Non-structural measures, as described for Cumberland, would also be beneficial at Luke.

Municipal and industrial water supply needs at Luke are related to those of Keyser, West Virginia, and will be discussed with State Planning Sub-region 19 - West Virginia.

Hagerstown Growth Center

The effluent from the secondary sewage treatment plant of Hagerstown, Maryland is discharged into Antietam Creek. If a pollution problem should occur, consideration should be given to a higher degree of waste treatment, and augmentation of flow by pumping from ground water

storage, or development of impoundments on Antietam Creek and tributaries. A potential upstream watershed improvement has been investigated on Little Beaver Creek, a tributary of Antietam Creek.

Other Problem Areas

Potential development along the Potomac River and projected water supply needs at downstream Washington, D.C., outside Appalachia, necessitate development of upstream impoundments to augment low flows and meet increased water supply demands. Town Creek, Sideling Hill, Little Cacapon, North Mountain, and the authorized Bloomington Reservoir are projects which would meet part of the projected water need for quality improvement and municipal water supply. They also provide basic facilities for public utilization of the project recreation opportunities. The Town Creek, Sideling Hill, Little Cacapon, and North Mountain Reservoirs are four of the six projects that are recommended in the Chief of Engineers Report on the Potomac River which is being processed to Congress. An authorized upstream watershed project on Little Youghiogheny River and a potential project on Upper Casselman River, both in Garrett County, Maryland, would provide 120 acres and 288 acres, respectively, of water surface for recreation. The Youghiogheny River has been designated as a potential addition to the National Wild and Scenic River System from Oakland, Maryland to the Youghiogheny Reservoir and is, therefore, considered as a non-structural measure for meeting recreation needs.

Upstream watershed improvements in the Potomac River Basin that are authorized or that have been investigated are listed in the following tabulation. The name of watershed, status, and purposes for which considered are shown.

Watershed	Status	Storage Purpose
N. Br. Potomac R.	Rec.	FC, Sed.
Georges Cr.	Potential	FC
New Cr.	Auth.	FC, Sed. WS
Mills Cr.	Potential	FC,WS,R, F&WL
Patterson Cr.	Auth.	FC, Sed. WS
N. Fork, S. Br.	Rec.	FC, Sed.
S. Br. Potomac R.	Rec.	FC, Sed.
Lunice Cr.	Auth.	FC, Sed.
Mill Cr.	Rec.	FC, Sed.
South Fork	Auth.	FC, Sed.
Little Cacapon	Rec.	FC, Sed.
North River	Rec.	FC, Sed. WQ
Lost River	Rec.	FC, Sed.
Tanoloway Cr.	Rec.	FC, Sed.
Sleepy Cr.	Rec.	FC, Sed. WS
Licking Cr.	Rec.	FC, Sed. WS,WQ
Opequan Cr.	Rec.	FC, Sed. WQ
Little Beaver Cr.	Potential	
Town Cr.	Rec.	Sed. WS
Cacapon R.	Rec.	FC, Sed.

FC - Flood Control; WS - Water Supply; Sed - Sediment; F&WL - Fish and Wildlife; WQ - Water Quantity; R - Recreation

The above listed improvements, if in operation, would reduce flood damage along the tributaries on which located and would provide a degree of regulation on the Potomac River. Some of the projects would provide storage for purposes other than flood control. Water supply from these could be utilized by some of the small communities and by rural water districts. Some storage for water quality improvement, largely on the tributary itself, could be provided. Most of the impoundments would have some recreation value, dependent on the interest of the individual land owners.

Acid mine drainage is a source of pollution in the Potomac River above Luke, Maryland. Abatement of this pollution is important in view of the authorized Bloomington Reservoir and is necessary for the restoration of a significant and valuable fishery and outdoor recreation resource. Considerations for alleviating mine drainage pollution include backfilling and restoration of strip areas, sealing and grouting of mines, diversion channels, and control and treatment of acid flows.

State Planning Sub-region 19 - West Virginia (See Figure 4-8, page 85.)

West Virginia Planning Sub-region 19 is comprised of eight counties: Jefferson, Berkeley, Morgan, Hampshire, Mineral, Grant, Hardy, and

Pendleton. There are seven growth centers in this planning sub-region: Martinsburg, Berkeley Springs, Keyser, Romney, Petersburg, Moorefield, and Franklin.

Luke-Keyser Growth Center

The Luke-Keyser growth center includes the communities of Luke and Westernport, Maryland and Keyser, West Virginia and, insofar as requirements for municipal and industrial water supply, their needs will be considered as one. This growth area has been hampered by inadequate water supply since 1960, at which time it was estimated that an additional 12 mgd were needed. The future requirements, above supply, are expected to reach 87 mgd by 1985, and 162 mgd by 2010. Keyser presently utilizes groundwater sources for both municipal and industrial purposes; Luke obtains its supply from a private water company, and Westernport utilizes a surface impoundment. Consideration of sources for expansion of water supply should include upstream watershed improvements on New Creek, Georges Creek, and withdrawal from the Potomac River.

It is estimated that average annual residual flood damages at Keyser will amount to $397,100 after Bloomington Reservoir is completed. Upstream watershed development would serve reduction in flooding from New Creek; however, the major benefit would be obtained by construction of the authorized levee which would protect against flooding from both New Creek and the North Branch of the Potomac River. Flood plain management, flood warning services, and an evacuation plan would serve to limit the increase of damages in the future.

Petersburg Growth Center

Petersburg is located on the South Branch Potomac River and has much land, both adjacent and across the river, that is ideally suited for industrial and commercial development if flood protection is provided. The city takes its water supply from the river, and the minimum low flow of record (64 cfs) should provide no constraint to future growth. The minimum low flow that would occur with the potential Royal Glen Reservoir in operation would be 100 cfs. Petersburg provides primary treatment to its municipal and industrial wastes. Plans to improve tannery waste treatment and the town's waste treatment facilities are underway. No pollution problem is anticipated.

The average annual flood damages in this community amount to $683,000. Various alternatives for preventing this flood damage are channel improvement, levees or flood walls, a reservoir upstream at or near the Royal Glen site, or some combination of these measures. Future damages might be reduced by a flood plain management program.

Moorefield Growth Center

The secondary growth center of Moorefield experiences average annual flood damages of $107,500. Reduction of flood stages and accompanying damages could be provided by measures such as a local

protection project, storage in the potential Royal Glen Reservoir project, and upstream watershed developments on the South Fork of the South Branch Potomac River.

Moorefield obtains its water supply from the South Fork, and in 1960, had a use rate of about 600,000 gallons per day. Water supply requirements are expected to reach 3.5 mgd by 2020. The present source is adequate.

Romney Growth Center

Romney, classified as a primary growth center, is closely allied to Cumberland, Maryland. There are no known flood problems. The city obtains its water supply from the South Branch Potomac River and in 1960 had a use rate of about 170,000 gallons per day. Use is expected to reach about 1.5 mgd by 2020; however, flow in the South Branch will be more than adequate. Flow in the South Branch is more than adequate to prevent development of water quality problems.

Berkeley Springs Growth Center

Berkeley Springs is closely connected with Hancock, Maryland, in industrial and commercial activities. It had a population of about 1200 in 1960 and will probably increase four to five fold by 2020. There are no known water supply problems, and none are expected to develop. The municipal and industrial wastes are emptied into Warm Springs Run. A pollution abatement program to improve water quality has been initiated.

Martinsburg Growth Center

Martinsburg, West Virginia is a part of the Hagerstown, Marvland growth center. Intermittent water quality problems occur due to seasonal industrial waste load increases even though secondary treatment is provided. If future water supply needs should exceed the present supply, potential solution of this problem would be transporting water from the Potomac River or from the potential North Mountain Reservoir, on Back Creek, development of storage in Opequon Creek, or development of groundwater supply.

Other Problem Areas

The Potomac River Basin Report recommended a system of reservoirs to provide augmented flows for improvement of water supply and quality at potential development sites on the Potomac downstream to Washington, D.C. Two of these proposed reservoir sites, Little Cacapon, and North Mountain, are located in State Planning Sub-region 19. Development of these reservoirs is designed to allow full public access through provision of basic recreation facilities to meet a portion of the sub-region's water oriented recreation demand.

AD-A041 387 CORPS OF ENGINEERS CINCINNATI OHIO F/G 8/6
DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. MAIN REPORT. PART--ETC(U)
NOV 69

UNCLASSIFIED NL

5 OF 7
AD
A041387

The Appalachian Highlands Recreation Study concluded that the Spruce Knob-Seneca Rocks National Recreation Area State Parks Complex offers potential as a recreation development in this state planning sub-region and recommends detailed study to determine market potential. The complex would include the 100,000 acre Spruce Knob-Seneca Rocks National Recreation Area, Blackwater Falls and Cannon Valley State Parks, three reservoirs, including the potential Royal Glen project, and two ski centers.

Authorized upstream watershed projects provide solutions to some of the rural and urban water related problems in the sub-region. The Lunice Creek proposal includes five structures and a reach of channel improvement to provide for sediment and flood control in portions of Grant County. Proposed storage for project purposes includes 1,339 acre-feet for sediment and 7,390 acre-feet for flood water. The New Creek-White Run proposal in Grant and Mineral Counties consists of 12 structures providing total storage of 864 acre-feet for sediment, 2,806 acre-feet for flood water, and 960 acre-feet for municipal and industrial water supply. Patterson Creek watershed project, also in Grant and Mineral Counties, consists of an 0.85-mile channel improvement and 35 structures which provide 1,997 acre-feet of storage for sediment, 25,807 acre-feet for flood control, and 184 acre-feet for water supply. The South Fork proposal includes 24 structures which provide 2,282 acre-feet of storage for sediment and 28,186 acre-feet for flood control in Hardy County.

State Planning Sub-region 19 contains eight potential upstream watersheds which were investigated by USDA and determined feasible. These projects would satisfy some of the water resource needs in the urban and rural portions of State Planning Sub-region 19. They are described in table 4-7.

TABLE 4-7
UPSTREAM WATERSHEDS FROM 1963 POTOMAC RIVER REPORT
LOCATED IN STATE PLANNING SUB-REGION 19

Watershed	Location	Number of Structures	Storage (acre feet) Flood Sediment	Prevention	Water Quality
North Fork South Branch	Grant Co., W.Va. Garrett Co., Md.	4	1592	11,114	
South Branch	Grant Co. Pendleton Co.	7	1779	12,420	
Mill Creek	Grant Co. Pendleton Co.	5	1023	7,142	
Little Cacapon River	Hampshire Co.	5	937	6,545	
North River	Hardy Co. Hampshire Co.	6	1195	8,693	495
Lost River	Hardy Co.	9	1917	13,390	
Sleepy Creek	Morgan Co.	8	1528	10,667	
Opequon Creek	Berkeley Co.	5	1968	1,951	21,285

Other Needs in Sub-region B

There are presently about 290,000 acres of cropland that will respond sufficiently to make installation of drainage measures economically feasible. Besides direct increases in yield, there will be additional yield from associated management measures such as more timely planting, cultivation, and harvest. In some instances, additional economic benefits are possible through reduced production costs due to fewer replantings and higher yields from the use of more fertilizer.

Areas in the sub-region needing sediment control measures include strip-mined land, road banks, and other critically eroded places. Through adequate land treatment and management and upstream watershed projects sediment damage can be significantly reduced on both public and private lands.

Bank stabilization is needed to prevent loss of valuable flood plain lands from agriculture production and other desirable uses. The loss of such lands lowers water quality through sedimentation, degradation of fishery habitat, and loss of recreational and aesthetic values, in addition to causing drainage problems. Bank stabilization can be accomplished through channel improvements and upstream watershed projects.

The Federal Power Commission, in Appendix B of the Appalachian Report, has determined electric power requirements for each of the 15 power supply areas contained wholly or in part by the Appalachian Region. Their study involved determinations of the present and future power requirements for both the normally expected growth conditions and for the stimulated "developmental benchmark" growth conditions.

Power supply might come from within the Appalachian Region, from outside the Region, or from a combination of facilities located within and outside the Region to meet the requirements. Much of the demand will be met with fossil fuel and, to an increasing degree, nuclear fueled thermal-electric generating facilities. Fortunately, both water and fuel are abundant in the Region and have been determined by the Federal Power Commission as sufficient to meet the electric power supply requirements beyond the year 2020. However, there is a need for hydroelectric power for meeting peak demands. This relatively mountainous area of the eastern United States provides a tremendous potential for pumped storage and some potential for conventional and combined conventional-pumped storage developments.

Water resource surveys over the past 30 years have identified many potential hydropower sites. Twenty-two sites within Sub-region B were considered potential by the Federal Power Commission (see Appendix B). Pumped-storage power may prove worthy of development in conjunction with reservoir projects developed for other purposes, or as single purpose power projects. The Raystown Dam, presently under construction, is designed so that power generation units can be added at a future date. Development of multiple purpose reservoirs to meet identified needs with power as a purpose is being studied in the Susquehanna Basin Study. Project sites which had potential for hydroelectric power development were identified in the Potomac River Basin Studies. Table 4-8 lists the potential hydroelectric power projects in Sub-region B.

Studies to determine the effects of nutrient, pesticide, and herbicide loadings on water quality are needed to determine the extent of regulation required to keep these problems from reaching harmful levels.

TABLE 4-8
SUB-REGION B - POTENTIAL HYDROELECTRIC POWER

Basin	Water Sub-Area	State Planning Sub-region	Installed Cap. MW	Gross Power Head, ft.	Type
Delaware					
Hawk Mt., N.Y.	B-1	2	21	148	conventional
Hancock, N.Y.	B-1	2	10	65	conventional
Ohio Basin - Youghiogheny					
Sang Run, Md.	B-3	37	48	560	conventional
Youghiogheny, Pa. 1/	B-2	7	24	125	conventional
Dam A, Pa.	B-2	7	25	85	conventional
Dam B, Pa.	B-2	7	25	85	conventional
Susquehanna					
Kettle Creek, Pa.	B-2	8	16	150	conventional
Lock Haven, Pa., W.Br. Susq.	B-2	8	80	82	conventional
Cammol, Pa., Pine Creek	B-2	8	85	225	conventional
Muncy, Pa., W.Br. Susq.	B-2	8	60	38	conventional
Raystown, Pa., Raystown Br.	B-2	7	270	166	conventional
Vineyard, Pa., Juniata	B-2	7	24	53	conventional
Marysville, Pa., Susq.	B-2	8	180	32	conventional
Potomac					
Mount Storm, W.Va., Stony Cr.	B-3	19	36	796	conventional
Bloomington, Md.-W.Va., N.Br. Potomac	B-3	19-37	600	1,175	pumped storage
Bloomington, Md.-W.Va., N.Br. Potomac	B-3	19-37	40	250	conventional
Royal Glen, W.Va., S.Br. Potomac	B-3	19	24	173	conventional
Springfield, W.Va., S.Br. Potomac	B-3	19	60	178	conventional
Eden Fort, W.Va., Cacapon 2/	B-3	19	120	225	combined
Orleans, Md.-W.Va., Potomac	B-3	19-37	10	55	conventional
No. Mountain, W.Va., Back Creek	B-3	19	400	900	pumped storage
Hedgesville, W.Va., Back Creek 3/	B-3	19	100	140	combined

1/ Existing Federal Flood Control Reservoir.
2/ Includes 120 MW of Reversible operating units.
3/ Reversible generating units.

SECTION IV - EVOLUTION OF THE SUB-REGION

WATER RESOURCES DEVELOPMENT PLAN

11. PLANNING CONSIDERATIONS

Water resources needs for the growth centers in Sub-region B have been described in Section II, and probable sources for meeting the needs were described in Section III. There are several local protection projects in the basins of this sub-region that are in authorized status, some of which are now in the advanced engineering and design stage. There are also several reservoir projects in these basins that have been authorized following submission of previous reports, five of which are now in advanced engineering and design status.

The assumption is made that these projects now in advanced engineering and design status will be completed prior to 1980. The assumption is also made that those authorized projects, both local protection and reservoir, that are not now in advanced engineering and design stage, will be reevaluated in the Susquehanna River Basin Comprehensive Study and recommendations will be made for their disposition. The one exception is the authorized local protection project in the Potomac River Basin at Keyser, West Virginia. The upstream watershed developments of the Department of Agriculture that are now existing, or authorized, are considered as a part of the water resources development that will be available for use by 1980. The same is true for the water resources improvements that have been made or which are now underway by the states, counties, cities, towns, or their political sub-division.

A comprehensive study of the water resources in the Susquehanna River Basin was authorized by Congress in 1961 and is nearing completion.

Studies made for the Potomac River Basin Report and the subsequent report by the Chief of Engineers were the basis for the applicable portion of Sub-region B in the Appalachian Water Resource Survey. The Potomac Report presented a comprehensive plan for the control, conservation, and efficient use of the water resources of the Basin to support the continued well-being of the inhabitants of the region. This plan was formulated to maximize net national benefits, to provide an equitable distribution in the Basin of beneficial and adverse effects, and to be flexible enough to be modified over time as actual development might vary from projected development and as technologic advances occur.

State Planning Sub-region 1 - New York

Needs and possible solutions for three growth areas have been discussed in Sections II and III. Based on the preliminary findings by the Susquehanna Coordinating Committee Study and New York State Supplemental Study in the Susquehanna Basin, better alternatives to meet needs in this Sub-region 1 are described below.

Hornell-Alfred Growth Center

The studies indicate that improvement of existing Hornell water supply system and development of additional groundwater sources appear to be better solutions for Hornell water supply needs, because there are no potential reservoirs which could provide conservation storage. The other alternative is the reallocation of storage in the existing Arkport and Almond Reservoirs. However, these reservoirs were not designed and constructed to hold conservation storage even though a small pool has been provided for recreation during the summer months. Therefore, major modification of these projects would be required.

For the same reasons, advanced waste treatment seems to be a better measure for water quality management for this area. Improvement of existing recreational facilities at Almond and Arkport Reservoirs could provide additional recreation opportunities.

Bath (Cohocton Valley-Hammondsport Growth Center)

As there is abundant groundwater in the area, ground water development appears to be a more economical solution in satisfying water supply and water quality needs for Bath. Potential upstream watershed improvements on Campbell Creek will provide flood protection on Campbell Creek and on the Cohocton River at the least cost.

The authorized upstream watershed project, Upper Five Mile Creek, through channel improvement, would reduce agricultural flood damages in rural areas near Bath.

Elmira (Elmira-Chemung Valley Growth Center)

The combined use of ground water and reservoir storage in Mud Creek was found to be a better solution for water supply for the Corning-Elmira area. Also, a combination of advanced waste treatment and flow augmentation from the potential Mud Creek Reservoir appears to be the most economical measure for Elmira water quality management. Flow release at the Mud Creek Reservoir required for Elmira would be sufficient to maintain the water quality standard at Corning.

The Mud Creek and Five Mile Creek Reservoirs would provide reduction in flood damages along the Cohocton and Chemung Rivers, and also provide recreation opportunities for this area.

A Newton-Hoffman Creek watershed development was determined by USDA to be feasible and will require authorization. This project would provide about $119,400 annual reduction in flood damages to residential and commercial improvements, roads, and railroads; furnish 0.3 mgd water supply to Elmira, and produce facilities for 42,000 recreation days for general recreation.

Others

The preceding paragraphs describe the better solutions to the needs associated with the growth centers. There are, however, other measures considered under the Susquehanna Study to meet various needs in the sub-region. There are seven potential upland reservoirs having less than 500 water surface acres for recreation, fishing, and flood damage reduction in agricultural lands. Land treatment and river bank stabilization measures are also considered in the Susquehanna Study.

A Tentative Program

A tentative early action program (1980) of water resources development and management for Sub-region 1 under the Susquehanna Study is summarized in Table 4-9. A map and schematic diagram of the various alternatives considered is shown on Figure 4-3.

TABLE 4-9
A TENTATIVE PROGRAM OF WATER
RESOURCES DEVELOPMENT FOR 1980, STATE PLANNING SUB-REGION 1

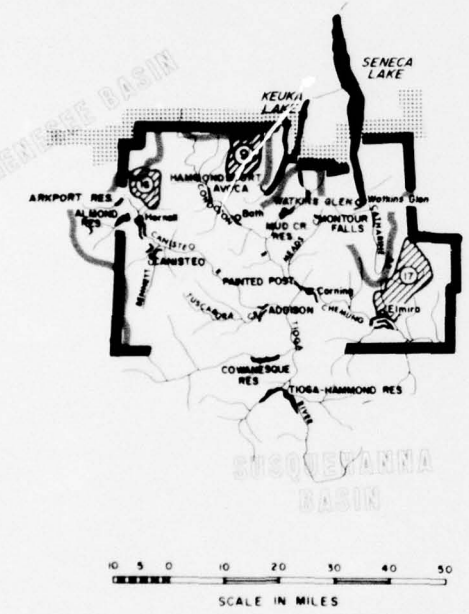
1. Reservoir Projects

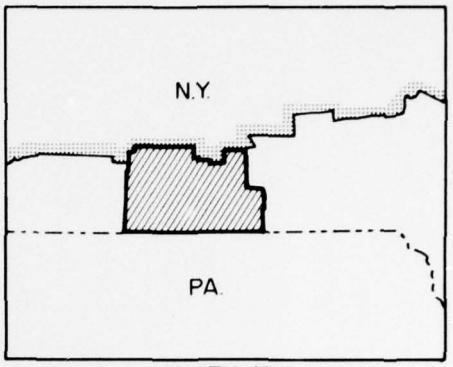
Name of Stream	Drainage Area (sq. mi.)	Total Storage (Ac.ft.)	Surface Area (Ac.)	Purposes*	Comments
Mud Cr.	75	28,000	2,000	FC.WS.WQ. R.F.	Serve Corning and Elmira
Campbell Cr.	23.9	9,060	247	FC.F.	
N. Br. Tuscarora Cr.	11.6	4,240	190	R.F.	
Little Tobehanna Cr.	3.6	1,380	135	R.F.	
Caton Cr.	3.2	1,250	175	R.F.	
Wynkoop Cr.	14.8	3,450	198	R.F.	
Baldwin Cr.	4.6	850	57	F.	
Elk Cr.	2.6	2,600	132	F.	

2. Other Measures

a. Groundwater development for water supply and advancement waste treatment for Hornell.
b. Groundwater development for water supply for Elmira.
c. Bank stabilization on Purdy Creek and Newtown Creek.
d. Land treatment.

* FC - Flood Control, WS - Water Supply, WQ - Water Quality
R - Recreation, F - Fishing





VICINITY MAP

LEGEND

RIVER BASIN BOUNDARY

STATE PLANNING SUB-REGION BOUNDARY

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LFP PROJECT

PLANNING ALTERNATIVES

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LFP PROJECT

Arkport Res

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

9 Upper Five Mile Creek

ALTERNATIVES AVAILABLE FOR PLANNING

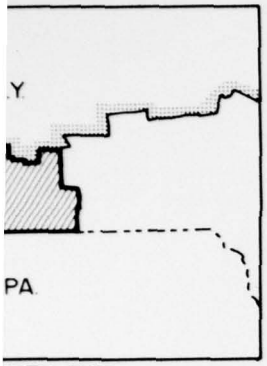
16 Marsh Ditch Creek

17 Newtown-Hoffman Creek

STATE PLANNING SUB-REGION I

NEW YORK

LOCATION MAP



NITY MAP

Y

-REGION BOUNDARY

BOUNDARY

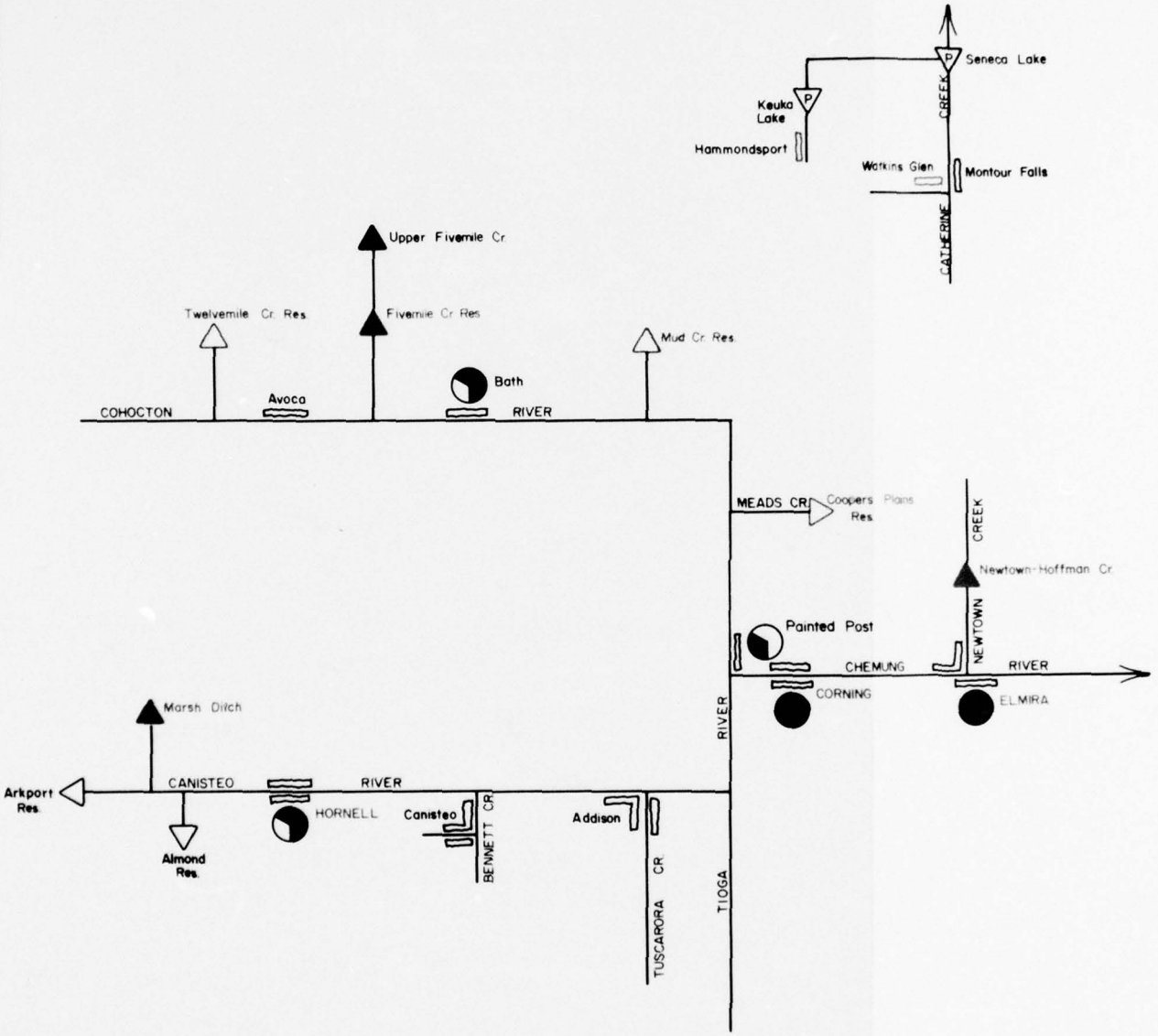
D PROJECT

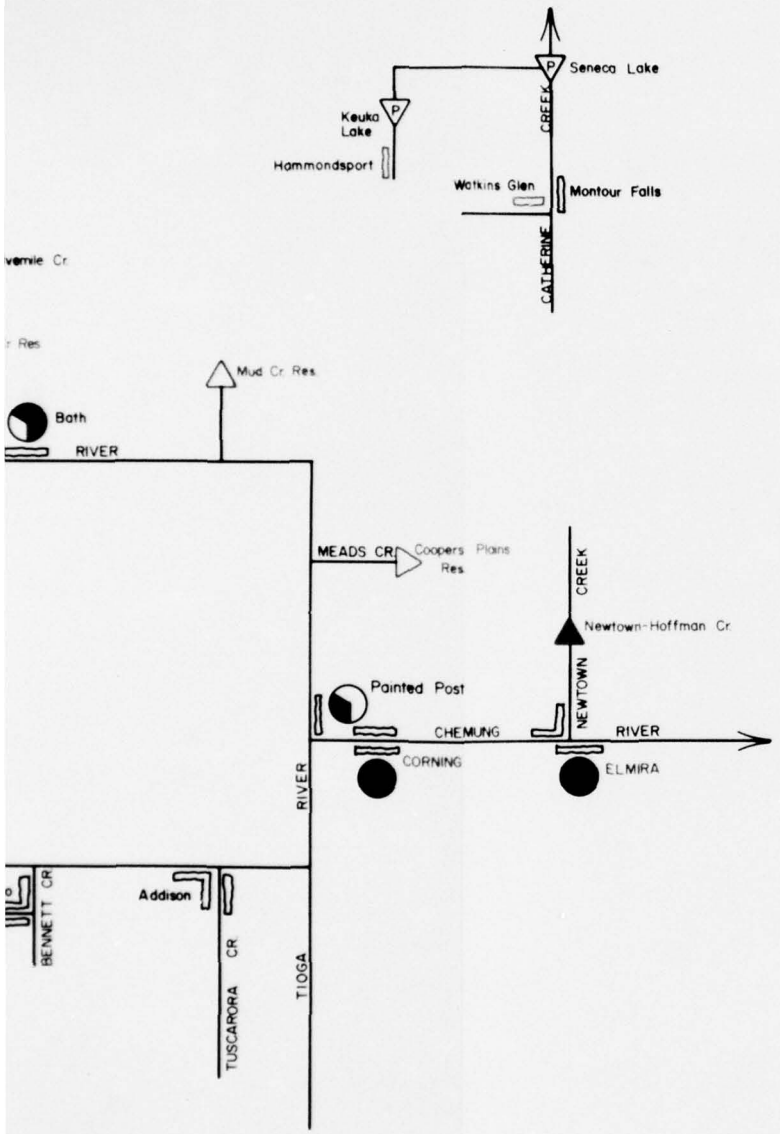
D PROJECT

ANNING SUB-REGION I

NEW YORK

ATION MAP





LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR; P DENOTES NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- ▭ LOCAL FLOOD PROTECTION PROJECT

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT
- ▭ LOCAL FLOOD PROTECTION PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER

Town Name SECONDARY GROWTH CENTER

STATE PLANNING SUB-REGION I

NEW YORK

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-4-61 FIGURE 4-3

State Planning Sub-region 2 - New York

There are four major growth complexes in Sub-region 2. Their water resources needs and possible solutions have been described in Sections II and III. Better alternatives considered by the Susquehanna Study and New York State Supplemental Study in the Susquehanna Basin are discussed at this point.

Susquehanna Valley Growth Complex (Oneonta, Unadilla, and Sidney)

Based on the reservoir cost and reservoir location, the studies indicate that Charlotte Creek Reservoir Complex is the best solution for providing flood protection for Oneonta, Unadilla, and Sidney, and recreational opportunities for this area. The reservoir complex which consists of two reservoirs, Davenport Center and T-2, could provide much better recreational facilities than Davenport Center alone. The complex has 42,000 acre-feet of flood control storage, 2,080 acres of water surface area for recreation, and 45,000 acre-feet of conservation storage for water supply and water quality needs in Sidney and Binghamton.

It appears that the Charlotte Creek reservoir complex will be the first major reservoir project to be built in State Planning Sub-region 2 because of flood control needs and of recreation pressure as the result of the proposed Interstate 88. Experience and judgment indicate that it should be built to reasonably full hydrologic development of the site. This is because (1) there is an increasing scarcity of good physical sites, and (2) opportunities greater than "the identifiable needs" may be generated in the future. Therefore, a safety factor, or some insurance, is required to meet additional needs that might result from greater economic development. Based on the New York State Study, the Davenport Center site of the Charlotte Creek complex could be built to have a maximum storage of 121,900 acre-feet. This will provide additional storage of 33,900 acre-feet for unforeseeable needs in the future. To meet the identifiable needs, 88,000 acre-feet are needed.

Chenango Valley Growth Complex

The studies indicate that the authorized South Plymouth Reservoir project has adequate capacity to provide flood protection for Norwich along Canasawacta Creek and along the Chenango River below Norwich at the least cost. This reservoir would provide 17,200 acre-feet for flood control, 20,800 acre-feet for water supply and 565 acres of water surface area for recreation.

Ithaca-Cortland Growth Complex

It appears that ground water is the best solution to meet water supply needs for Cortland. Ground water in this area has good quality and could be developed at the least cost. However, ground water yield is not high enough to provide low flow augmentation. Flow release from the potential SCS 49-28 site on a tributary of the Tioghnioga

River is considered a better measure than advanced waste treatment for water quality management for Cortland. It would provide 7,800 acre-feet for flood control for Cortland and the Tioughnioga River, 21,200 acre-feet for flow augmentation, and 1,410 acres for recreation. This site has the most economical storage potential upstream of Cortland, and it has good qualities for general recreation. Ithaca water suppy needs could be met by impoundments on Fall and Vergil Creeks.

A local flood protection project, in addition to SCS 49-28, would provide adequate flood protection for Marathon on the Tioughnioga River.

Binghamton-Owego-Susquehanna Growth Center

As discussed above, the Charlotte Creek Reservoir complex would provide flood protection, water supply, and water quality needs for Binghamton. Additional flood protection could be provided by the potential East Guilford Reservoir on the Unadilla River. The East Guilford site would provide 5,000 acres of water surface area and would have potential for trans-basin diversion. However, this site is considered to be a better alternative to meet long range needs by the Susquehanna Study.

It should be pointed out that the Charlotte Creek Reservoir complex, SCS 49-28, and South Plymouth Reservoir were considered as a system of reservoirs in Sub-region 2 to meet 1980 needs for upstream communities as well as downstream communities such as Binghamton, Endicott, and Johnson City.

The East Guilford site was added to the system to meet the long range needs.

Others

In addition to the alternatives discussed in the preceding paragraphs, 14 potential upland reservoirs were considered to be better projects for recreation and fishing, and flood damage prevention for agricultural areas. Land treatment measures were also considered. Upstream watersheds which have been developed under PL-566 should be implemented in addition to the Susquehanna plan. Authorized projects included in the Appalachian plan to reduce urban flood damages of residential and commercial improvements are Genegantslet Creek, Nanticoke Creek, Patterson, Brixius and Grey Creeks, Little Choconut Creek, Finch Hollow, and Trout Brook watershed developments.

The Genegantslet Creek project, which would provide 10,000 recreation days, should be coordinated with U.S. Army Engineer District; in view of the authorized Genegantslet Reservoir on the same stream.

The Mill Brook upstream watershed project was investigated by USDA to reduce flood damages to residential and commercial improvements.

The development was determined to be feasible and will require authorization. A potential watershed development on Cayuga Inlet would provide an estimated $135,200 average annual reduction in flood damages to residential and commercial improvements, roads and bridges, and agricultural lands.

The more plausible alternative to reduce the flood problem at Delhi, located in the Delaware Basin, appears to be a combination of channel modification, levees, walls, and filling low areas to protect against the 100-year flood. The area to be protected is the only suitable land zoned for commercial and light industrial development and at the present time is approximately 35 percent developed. The state of New York has required Delhi to complete its municipal sewerage installation by 1971, and the area to be protected is the only light industrial site to be served by the new system. Implementation of the Delhi local protection is being expedited through the Corps of Engineers' program of continuing authorities.

Additional consideration of the Delhi-Otsego-Cooperstown State Park Complex is recommended in the Appalachian Highland Recreation Study as a measure to satisfy a portion of the recreation demand.

A Tentative Program

A tentative early action program of water resource development for State Planning Sub-region 2 under the Susquehanna Study is summarized in Table 4-10. A map and schematic diagram of the various alternatives considered is shown in Figure 4-4.

TABLE 4-10
A TENTATIVE PROGRAM OF WATER RESOURCES
DEVELOPMENT FOR 1980, STATE PLANNING SUB-REGION 2

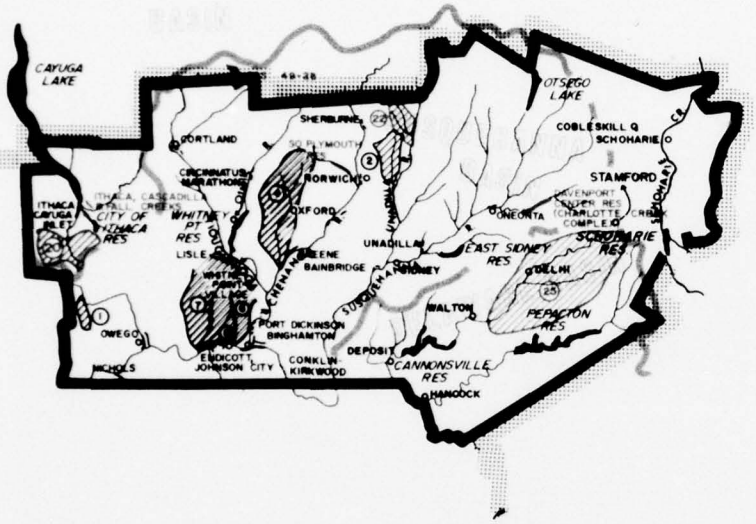
1. Reservoir Projects

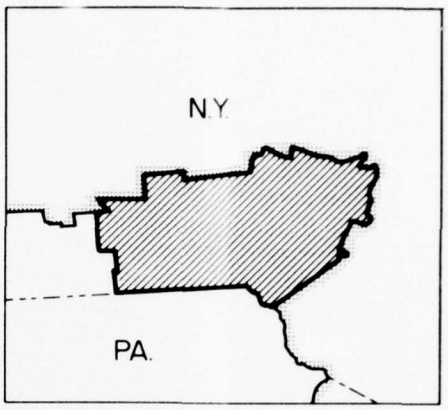
Name of Stream	Drainage Area (sq. mi.)	Total Storage (Ac.ft.)	Surface Area (Ac.)	Purposes*	Comments
Charlotte Cr.	164	121,900	2,170	FC.WS.WQ. R.F.	Serve WS for Sidney and WS.WQ. for Binghamton
Charlotte Cr.	114	5,500	400	R.F.	
Canasawacta Cr.	57	38,000	565	FC.WS. R.F.	Serve WS for Norwich
Tioughnioga Cr.	36.4	31,000	1,410	FC.WQ. R.	Serve WQ for Cortland
Trib. to Otsego L.	2.1	1,330	90	R.F.	
Still Cr.	4.0	2,560	125	FC. R.F.	
Little Snake Cr.	3.0	1,920	125	R.F.	
Trout Brook	15.7	3,600	76	FC. R.	
Smith Brook	8.6	1,500	-	FC.	
Thomas Creek	9.5	225	90	R.	
Chenango Creek	10.1	1,920	93	F.	
Trib. to Shapley Br.	2.0	4,600	180	F.	
Trib. to Crocker Cr.	2.5	6,300	159	F.	
Nanticoke Cr.	0.6	1,250	63	F.	
Michigan Cr.	2.7	4,100	303	F.	
-	5.8	4,400	206	F.	
Mill Brook	5.7	3,625	200	R.F.	
Bear Swamp Pond	0.4	1,280	82	F.	

2. Other Measures

a. Groundwater development for water supply for Cortland.
b. Land treatment for about 800,000 acres.
c. Local flood protection project at Marathon.

* FC - Flood Control, WS - Water Supply, WQ - Water Quality





VICINITY MAP

LEGEND

- RIVER BASIN BOUNDARY
- STATE PLANNING SUB-REGION BOUNDARY
- APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1980

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- LFP PROJECT

PLANNING ALTERNATIVES

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- LFP PROJECT

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

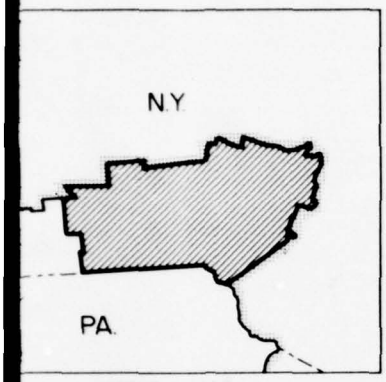
1 Dean Creek
2 Great Brook

ALTERNATIVES AVAILABLE FOR PLANNING

4 Genegantslet Creek
6 Little Choconut, Finch Hollow, Trout Brook
7 Nanticoke Creek
8 Patterson, Brixius, Grey Creeks
20 Cayuga Inlet(Enfield)
22 Mill Brook
25 West Branch Delaware River
a Fall Creek

STATE PLANNING SUB-REGION 2
NEW YORK

LOCATION MAP



VICINITY MAP

BOUNDARY
NG SUB-REGION BOUNDARY
REGION BOUNDARY

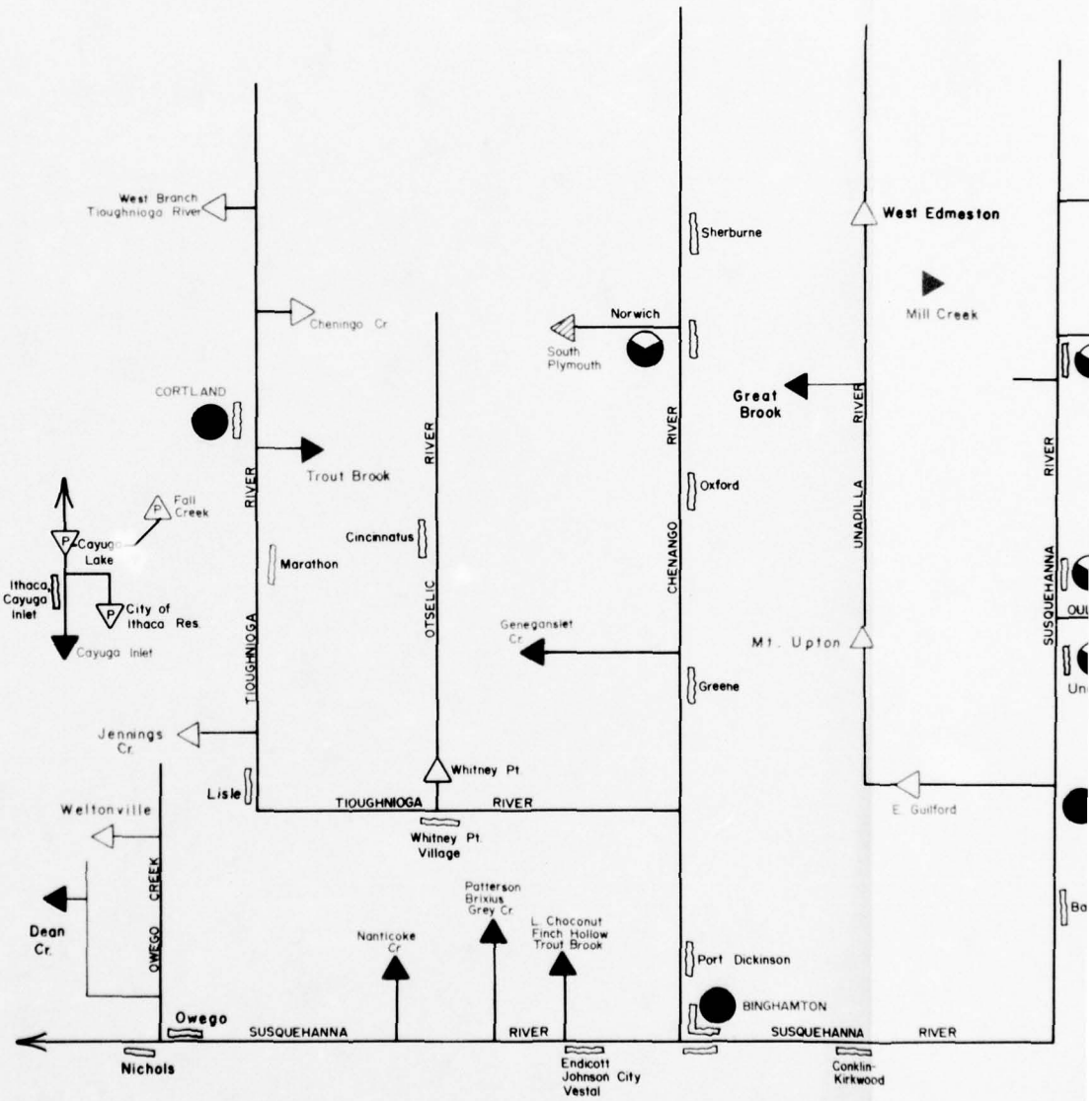
BY 1980

VOIR
ATERSHED PROJECT

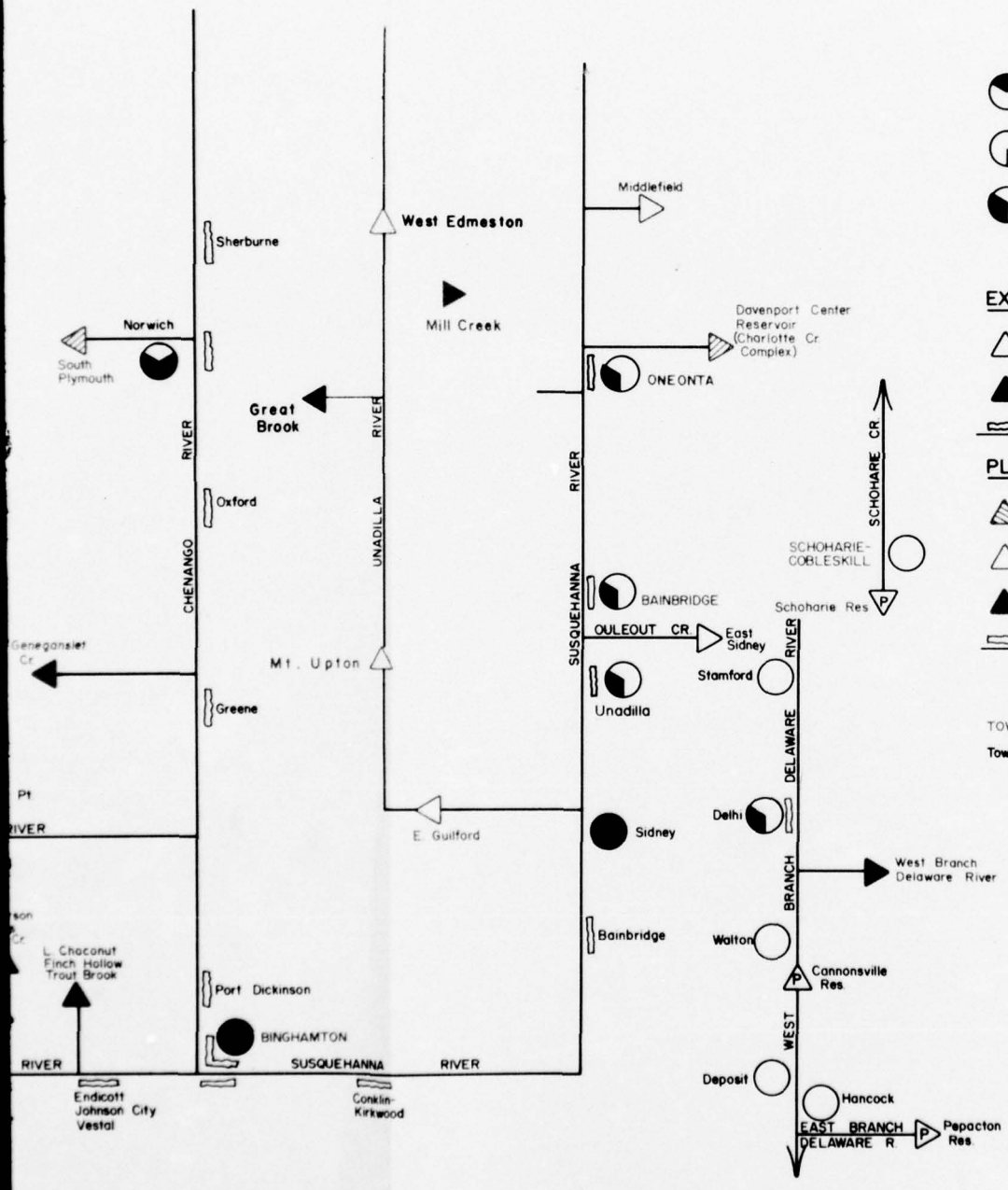
S

VOIR
ATERSHED PROJECT

PLANNING SUB-REGION 2
NEW YORK



CATION MAP



LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- UPSTREAM WATERSHED PROJECT
- LOCAL FLOOD PROTECTION

PLANNING ALTERNATIVES:

- AUTHORIZED RESERVOIR (CE)
- MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- UPSTREAM WATERSHED PROJECT
- LOCAL FLOOD PROTECTION

OTHER

TOWN NAME PRIMARY GROWTH CENTER

Town Name SECONDARY GROWTH CENTER

STATE PLANNING SUB-REGION 2

NEW YORK

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

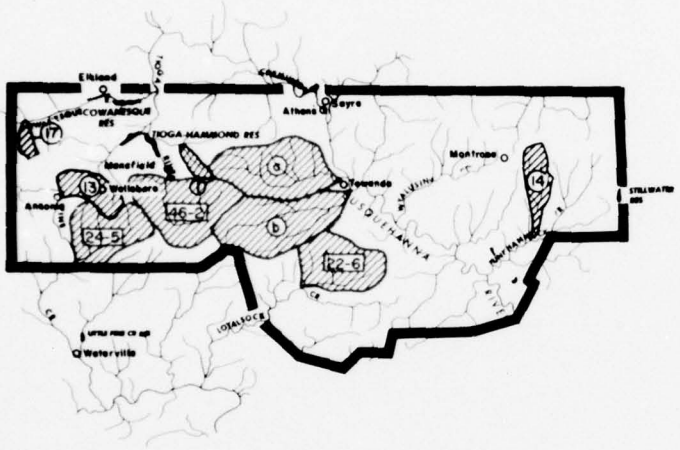
II-4-67 FIGURE 4-4

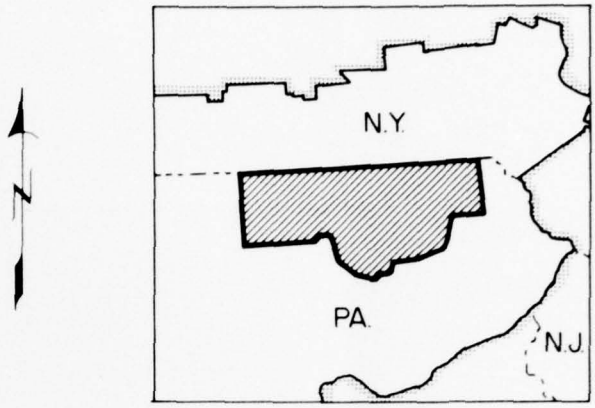
State Planning Sub-region 9 - Pennsylvania

Authorized upstream watershed projects on Mill, Marsh, Martin and Cory Creeks, designed to reduce flood damages to residential and commercial improvements in Tioga and Susquehanna Counties, are included in the Appalachian Study to supplement the effects of the Susquehanna development plan. A map and schematic diagram of the various alternatives considered are shown in Figure 4-5.

The "Vacationscape" recreation study for north central Pennsylvania and the Susquehanna-North Tier Complex proposals are included in the Appalachian development plan to satisfy a portion of the recreation demand. Both of these projects will require additional studies to determine the major benefits which could be generated by development of the respective areas and to investigate a schedule of private and public development to maximize the economic benefits which can be precipitated. The "Vacationscape" study concluded that intensive year-round recreation development in the study area was desirable since the area offers an excellent potential for this type of development. The next step is to conduct a study to identify the specific locations where recreational facilities should be constructed, and to develop other specific details of the sites, including cost-benefit analysis and recommendations for authorization of projects. This study would be conducted by the Corps of Engineers in close cooperation with Federal, state, and local agencies so that the final plan would be compatible with state and local development plans.

Acid mine drainage abatement in the Tioga River and tributaries is under consideration in the Susquehanna Study. The Commonwealth of Pennsylvania and the Federal Water Pollution Control Administration (FWPCA) have been involved in studies to identify the sources of major acid flows and formulate effective abatement measures. Pennsylvania considers mine drainage pollution abatement a high priority effort. Preliminary estimates by the State indicate that pollution abatement and reclamation in the Tioga basin would cost about $7.25 million. Accelerated action to achieve water quality improvement is significant in view of the downstream authorized Tioga-Hammond Reservoir.





VICINITY MAP

10 5 0 10 20 30 40 50

SCALE IN MILES

LEGEND

STATE PLANNING SUB-REGION BOUNDARY

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LFP PROJECT

PLANNING ALTERNATIVES

UPSTREAM WATERSHED PROJECT

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

13 Marsh Creek
14 Martin Creek
17 Mill Creek
1 Cory Creek

ALTERNATIVES AVAILABLE FOR PLANNING

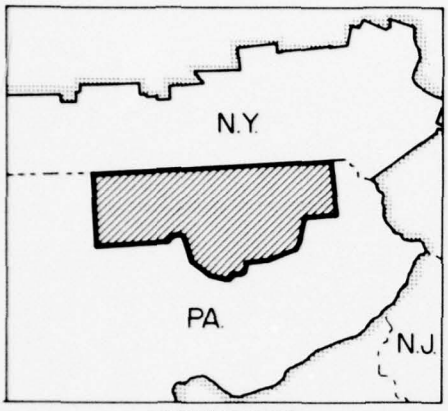
a Sugar Creek
b Towanda Creek
22-6 Little Loyalsock Creek
24-5 Babb Creek
46-2 Upper Tioga River

STATE PLANNING SUB-REGION 9

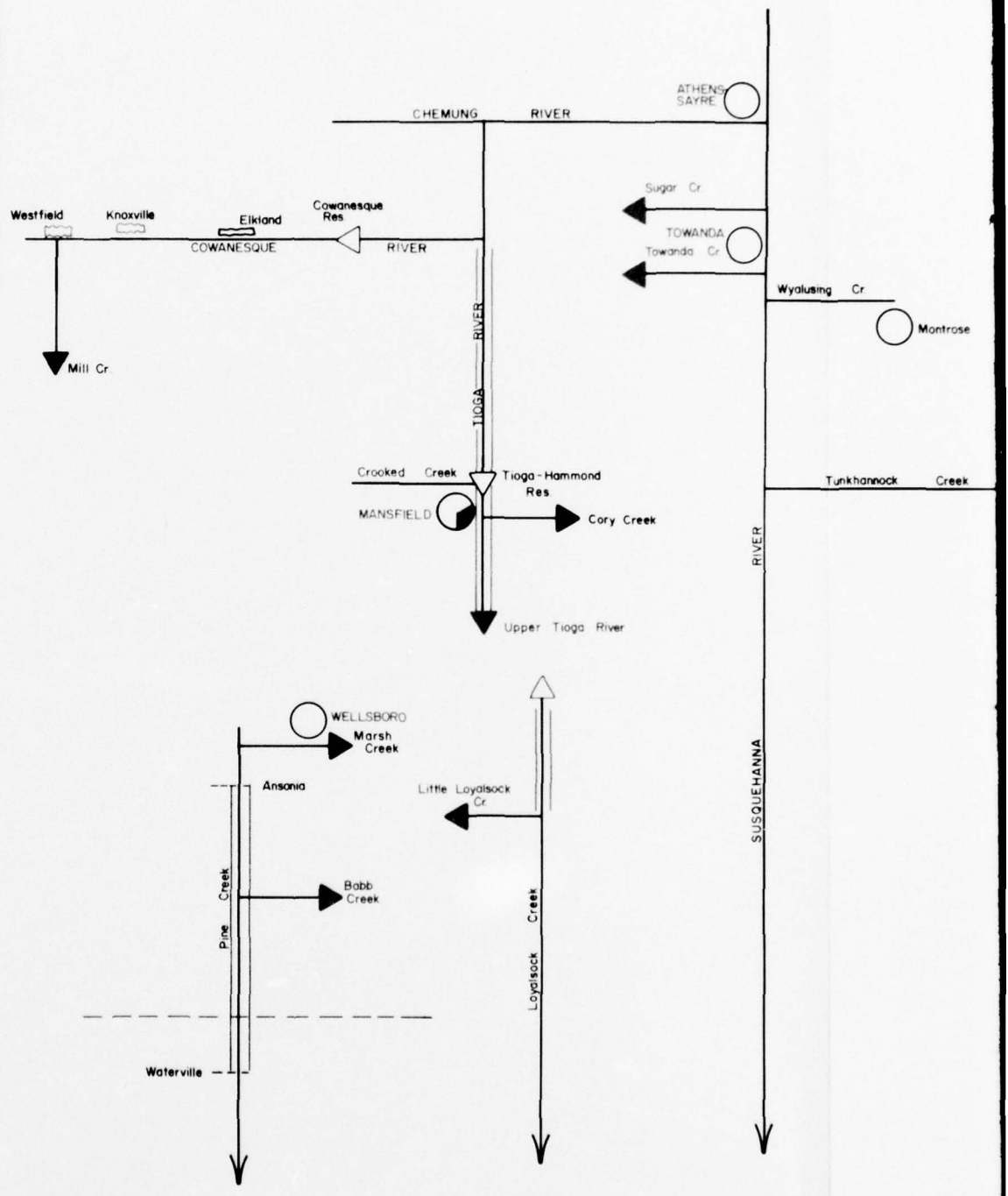
PENNSYLVANIA

LOCATION MAP

PRECEDING PAGE BLANK-NOT FILMED



VICINITY MAP



EGEND

PLANNING SUB-REGION BOUNDARY

ACHIAN REGION BOUNDARY

EXIST BY 1980

RESERVOIR

AM WATERSHED PROJECT

ROJECT

NATIVES

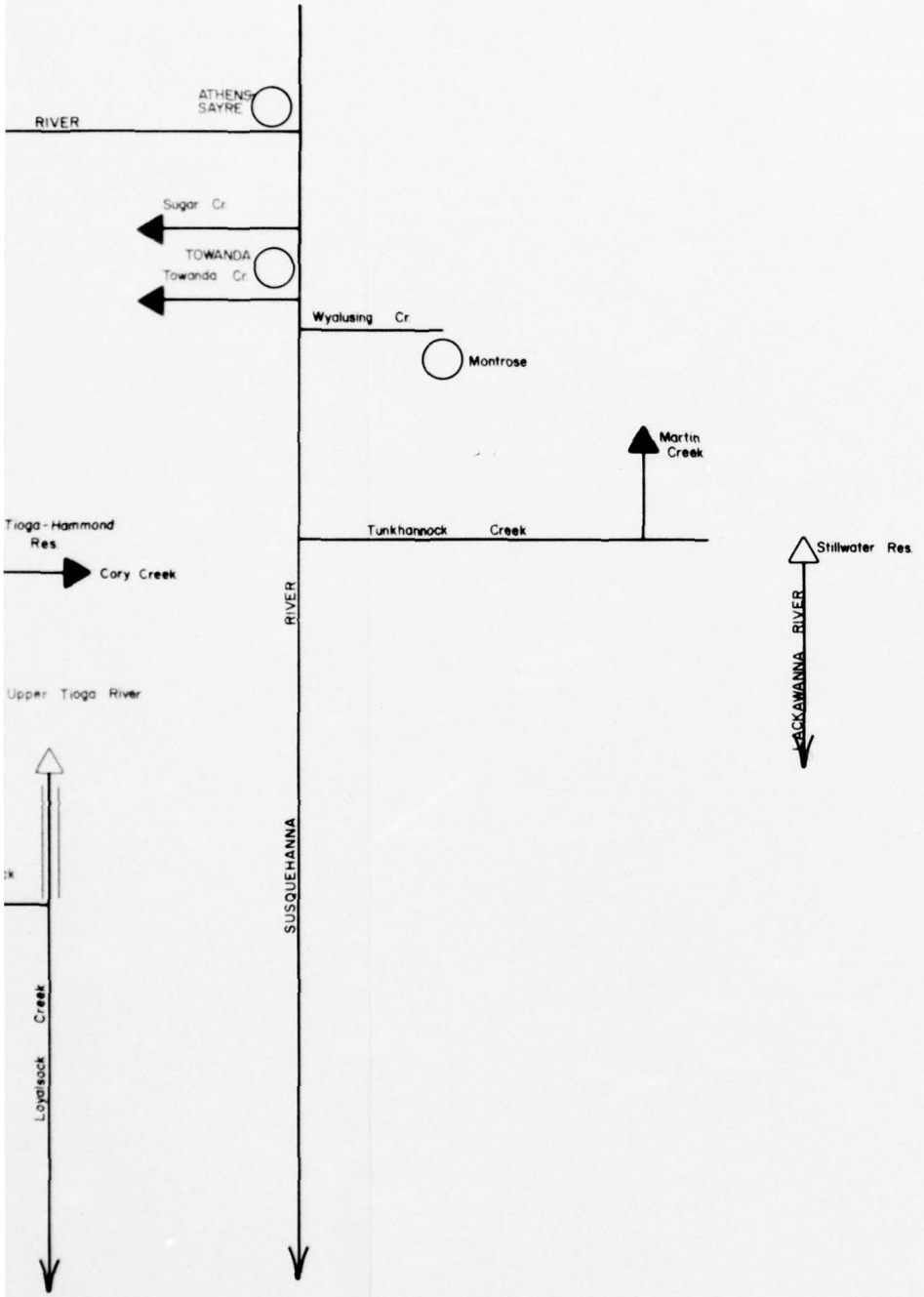
AM WATERSHED PROJECT

STATE PLANNING SUB-REGION 9

PENNSYLVANIA

LOCATION MAP

8



LEGEND

WATER SUPPLY

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LFP PROJECT

PLANNING ALTERNATIVES:

UPSTREAM WATERSHED PROJECT

OTHER

SCENIC STREAM

TOWN NAME PRIMARY GROWTH CENTER

Town Name SECONDARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

CONTINUOUSLY

STATE PLANNING SUB-REGION 9

PENNSYLVANIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-4-71 FIGURE 4-5

3

State Planning Sub-region 8 - Pennsylvania

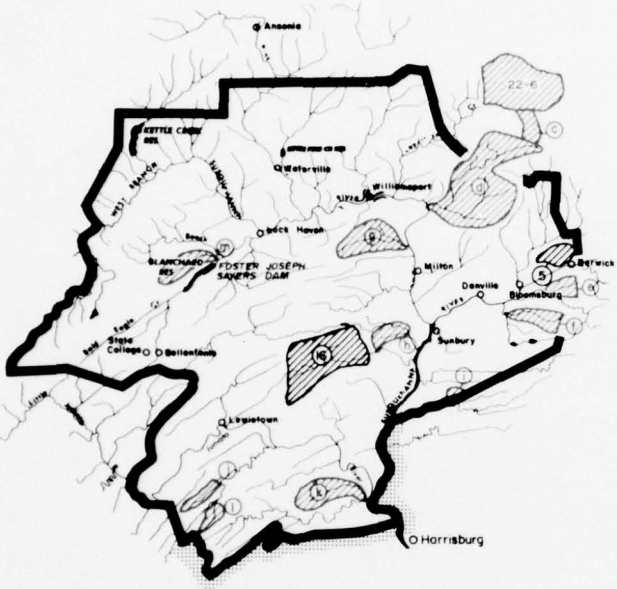
Authorized upstream watershed projects on Briar and Middle Creeks are included in the Appalachian plan to provide reduction of flood damages to commercial and residential improvements.

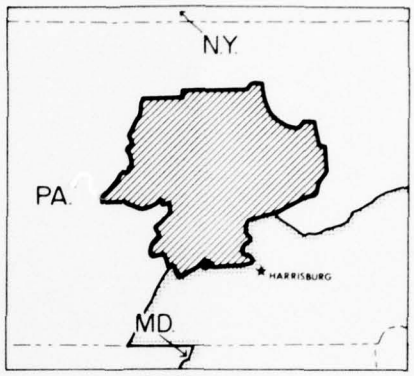
A flood plain information study at Bloomsburg would provide data which could guide planners in the wise use of flood plain lands.

The local flood protection for Danville is described in Section II of this chapter and has been implemented in part by the Commonwealth of Pennsylvania.

A map and schematic diagram of the various alternatives considered are shown in Figure 4-6.

Abatement of acid mine drainage in the West Branch Susquehanna River is under consideration in the Susquehanna Study. The Commonwealth of Pennsylvania and the Federal Water Pollution Control Administration have conducted studies to locate acid mine drainage sources in the basin. The Pennsylvania Department of Mines and Mineral Industries, through a land and water conservation bond issue, have a series of pollution abatement projects in various stages of completion. Within this state planning sub-region, projects are under way on Kettle and Beech Creeks to locate sources and recommend pollution abatement measures. The cost of reclamation and abatement in the West Branch Susquehanna, part of which lies in Water Sub-region F, is estimated by the State to be $7.7 million.





VICINITY MAP

10 5 0 10 20 30 40 50

SCALE IN MILES

LEGEND

STATE PLANNING SUB-REGION BOUNDARY

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LFP PROJECT

PLANNING ALTERNATIVES

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LFP PROJECT

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

5 Briar Creek
16 Middle Creek

ALTERNATIVES AVAILABLE FOR PLANNING

22-6 Little Loyalsock Creek
c Larry's Creek
d Muncy Creek
e Tributary of Catawissa Creek
f Tributary of Roaring Creek
g Turtle Creek
h Pine Creek
i Tributary of Mahantango Creek
j Tributary of Tuscarora Creek
k Little Juniata Creek
l George Creek
m Big Run Creek

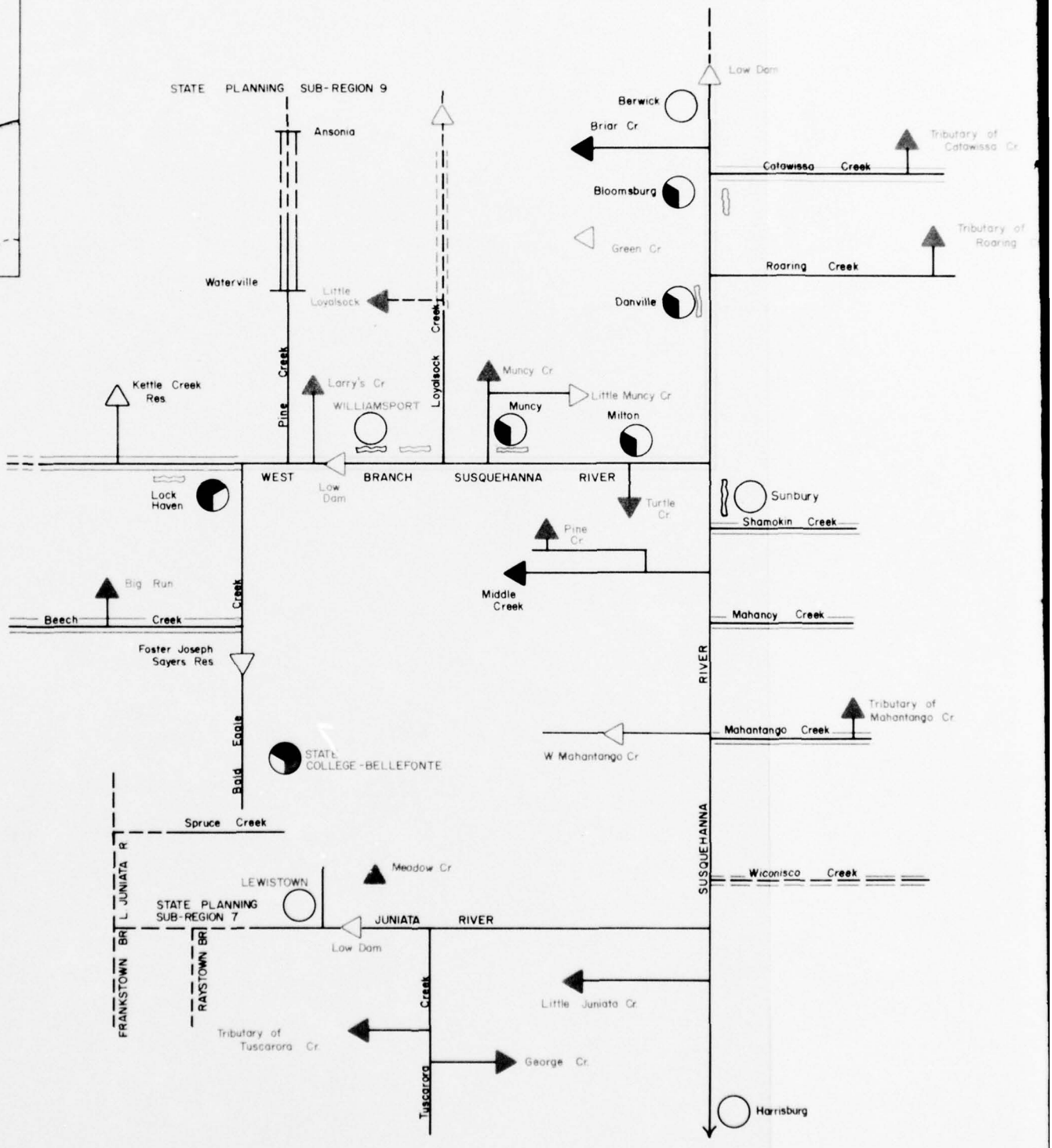
STATE PLANNING SUB-REGION 8

PENNSYLVANIA

LOCATION MAP

PRECEDING PAGE BLANK-NOT FILMED

VICINITY MAP



UB-REGION BOUNDARY
N BOUNDARY
O

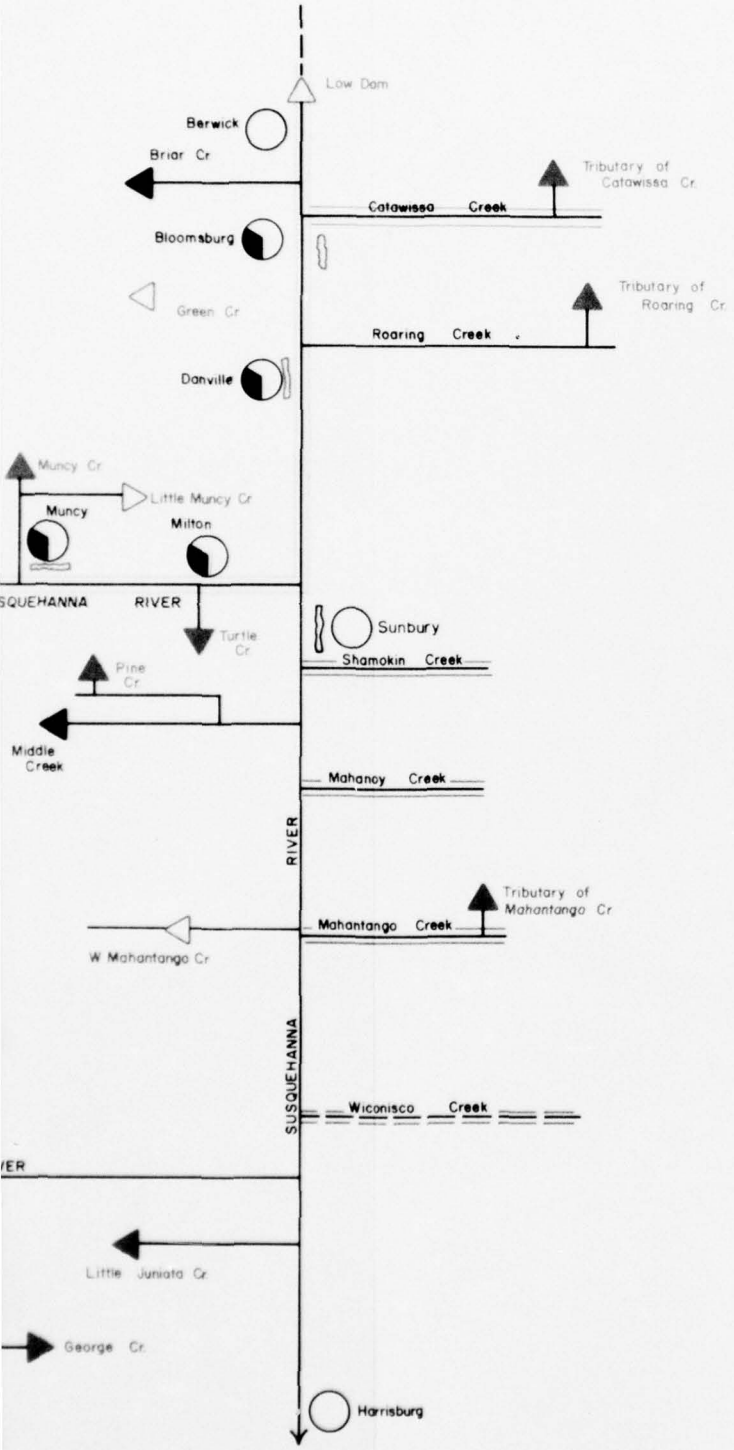
ED PROJECT

ED PROJECT

IING SUB-REGION 8
NSYLVANIA

ION MAP

2



LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- LFP PROJECT

PLANNING ALTERNATIVES:

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- LFP PROJECT

OTHER

- SCENIC STREAM
- TOWN NAME PRIMARY GROWTH CENTER
- STREAM AFFECTED BY POLLUTION
  - CONTINUOUSLY
  - INTERMITTENTLY

STATE PLANNING SUB-REGION 8
PENNSYLVANIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-4-75 FIGURE 4-6

3

State Planning Sub-region 7 - Pennsylvania

Basin studies of the Allegheny and Youghiogheny Rivers should be accelerated to identify water resource needs in the respective areas and determine the most feasible measures to satisfy those deficiencies in view of the Appalachian objectives.

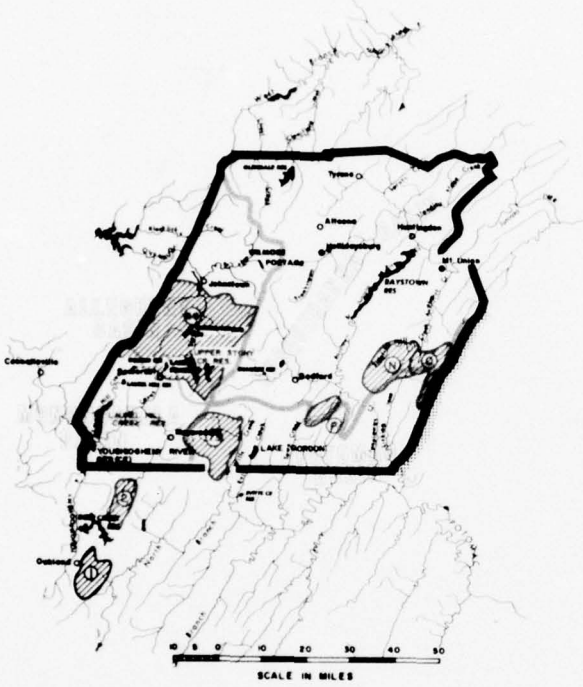
Potential upstream watershed developments on Wills and Stony Creeks are recommended with high priorities by the USDA and the State of Pennsylvania, respectively. These developments would provide protection from the 100-year event in areas with industrial potential. The Wells Creek project would provide $68,000 average annual flood damage reduction, principally for commercial and residential improvements, in Bedford and Somerset Counties, 1.5 mgd water supply for Hyndman, and facilities for some 462,800 recreation days in general activities. Stony Creek development would reduce average annual flood damages to agricultural lands and commercial and residential improvements by approximately $181,300 and provide general activities for an estimated 236,000 recreation days. The Stony Creek proposal will require joint study with the Corps of Engineers in view of the potential Upper Stony Creek Reservoir under consideration by the Pittsburgh District.

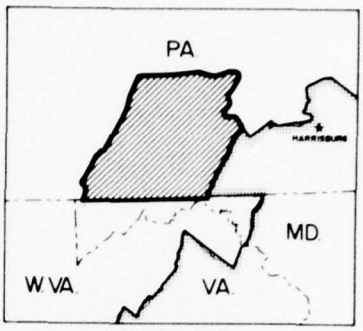
The Federal Water Pollution Control Administration and the Commonwealth of Pennsylvania have made studies to identify acid sources and abatement measures within the Casselman River Basin. Remedial measures range from an FWPCA estimate of $908,000 to abate pollution from inactive or abandoned mines to a state estimate of $5 to $7 million for complete restoration. Acceleration of abatement measures would restore fish and other aquatic life to the Casselman and Youghiogheny Rivers, protect water quality in the Ohiopyle State Park, and reduce water treatment costs for downstream water companies currently serving some 105,000 people.

The Naturealm Conservation and Education Area will contribute greatly to the preservation of the natural environment of this area and should be carried to completion in the immediate future. The plan would use an existing water setting to provide conservation education programs and would supplement the contemplated development of private year-round recreation and water sports activities in contiguous areas. The program should maximize the potential of this scenic area where the economy has been depressed by losses of jobs in railroading, coal mining, steel manufacturing, and farming. It is estimated that the project would, directly or indirectly, create 3,100 new jobs providing a $16 million payroll with $10 million gross annual sales income.

Other potential recreation developments in the area which will require further studies of market possibilities are the Raystown State Park and Deep Creek-Youghiogheny-Casselman-Laurel Mountains Interstate Complexes.

The Commonwealth considers Altoona, Tyrone, and Huntington as communities which need flood plain information reports to assist planners in determining use of flood plain lands. A map and schematic diagram of the various alternatives considered are shown in Figure 4-7.





VICINITY MAP

LEGEND

RIVER BASIN BOUNDARY

STATE PLANNING SUB-REGION BOUNDARY

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR

LFP PROJECT

PLANNING ALTERNATIVES

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LFP PROJECT

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

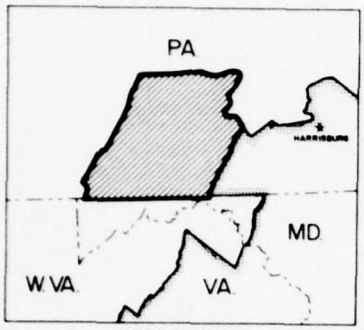
1 Little Youghiogheny River

ALTERNATIVES AVAILABLE FOR PLANNING

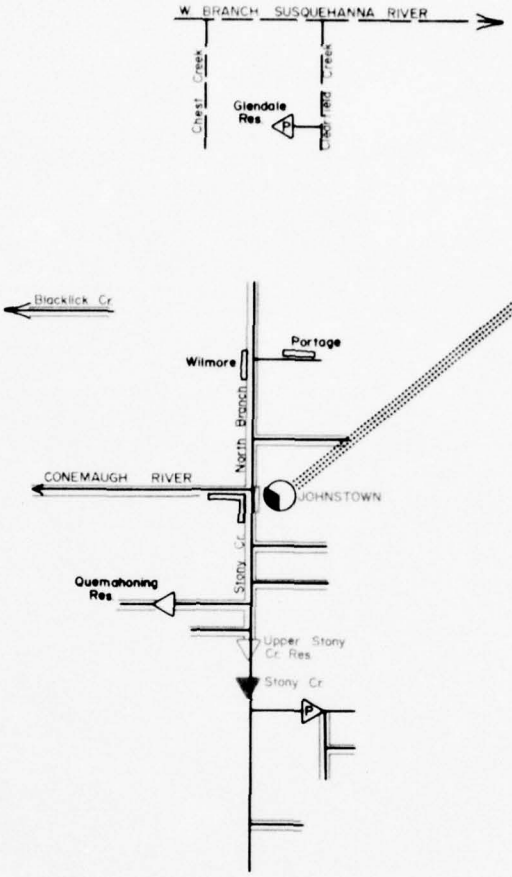
2 Upper Casselman River
66 Stony Creek
73 Wills Creek
n Sideling Hill Creek
o Little Aughwick Creek
p Chapman Run

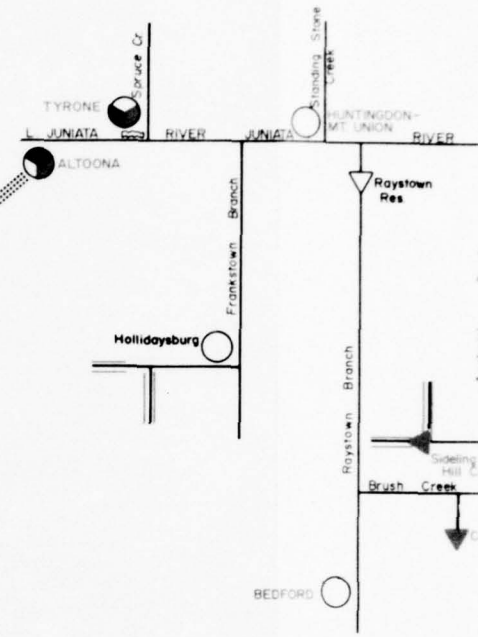
STATE PLANNING SUB-REGION 7
PENNSYLVANIA

LOCATION MAP



VICINITY MAP





LEGEND

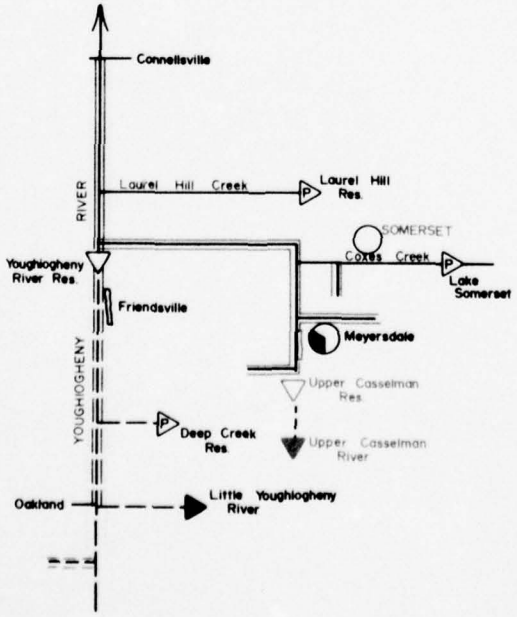
ER BASIN BOUNDARY
TE PLANNING SUB-REGION BOUNDARY
PALACHIAN REGION BOUNDARY

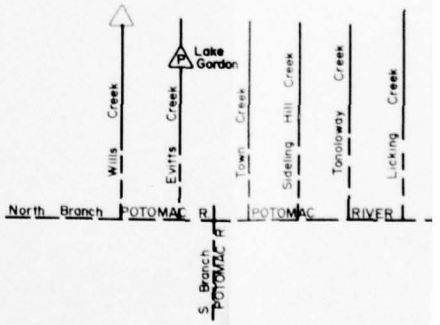
TO EXIST BY 1980

JOR RESERVOIR
P PROJECT

TERNATIVES

JOR RESERVOIR
STREAM WATERSHED PROJECT
P PROJECT

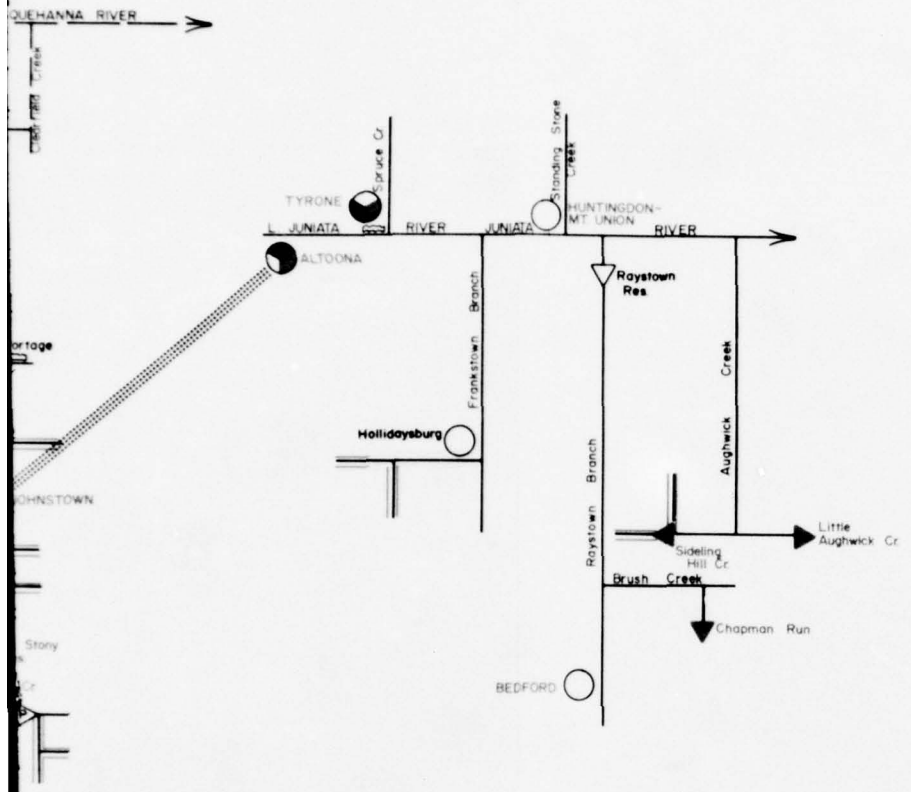


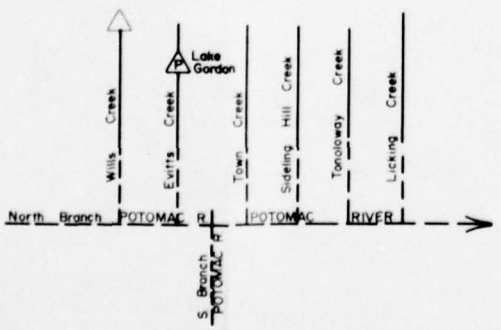


STATE PLANNING SUB-REGION 7
PENNSYLVANIA

LOCATION MAP

8





LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- LFP PROJECT

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT
- LFP PROJECT

OTHER

- SCENIC STREAM
- TOWN NAME PRIMARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

- CONTINUOUSLY
- INTERMITTENTLY

STATE PLANNING SUB-REGION 7
PENNSYLVANIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-4-79 FIGURE 4-7

State Planning Sub-region 37 - Maryland

The Bloomington Reservoir would reduce flood damages along the Potomac River by about 42 percent, with benefits amounting to approximately $921,000 annually. Reductions would be provided at Cumberland and Luke, Maryland, and Piedmont and Keyser, West Virginia (State Planning Sub-region 19), allowing for expansion of existing industry and flood free sites for new developments. Storage will be provided for low flow augmentation to satisfy both immediate and near future water supply and quality improvement needs to support municipal and industrial expansion in downstream centers. Recreation at the reservoir, although limited due to the severe topography of the shoreline, will provide activities for approximately 50,000 recreation days and will create employment opportunities in the operation of the facilities and supporting services. Estimated cost of the project is $73.5 million.

The Town Creek reservoir project has been studied in survey scope and recommended by the Chief of Engineers for authorization and early construction. The facility would provide increased dependable flows for water supply and quality requirements at Washington, D. C., water based recreational opportunities, fish and wild life enhancement, and stimulation of economic activities in adjacent counties. Ultimate visitations to the reservoir should produce 534,000 recreation days. The initial project costs are estimated to be $13,190,000 and expansion effects total $583,000 annually.

The Sideling Hill Reservoir has also been recommended for authorization and early construction by the Chief of Engineers as an element in the Potomac River development plan. The project will provide recreation and fishing opportunities for an estimated 534,000 recreation days annually and provide storage which would augment flows to meet municipal and industrial water supply requirements for the Washington Metropolitan Area. Initial construction costs are estimated to be $13,600,000 and expansion effects in adjacent areas should approach $347,000 annually.

The Little Youghiogheny River watershed development, an authorized PL-566 project, would provide about $52,000 annually in reduction of flood damages to agricultural lands, 253 acre-feet of storage for municipal and industrial water supply, and 65,900 recreation days in general activities. Potential watershed developments on Upper Casselman River and George's Creek are considered high priorities for further investigation. The Upper Casselman River project must be coordinated with the Corps of Engineers in view of that agency's consideration of the Upper Casselman Reservoir. However, as proposed, the watershed development would provide average annual flood reduction of $135,200 primarily to residential and commercial improvements; 2 mgd water supply to Salisburg, Boynton, and Meyersdale, Pa., and 200,000 recreation days through fishing and general recreation activities. The George's Creek project would provide annual flood damage reductions of $80,600 to residential and commercial improvements.

The Potomac River Basin Study determined that upstream watershed developments on the Potomac River, Town Creek, Tonoloway Creek, and Licking Creek are feasible and would satisfy some of the water resource needs in this state planning sub-region. The four projects would provide average annual benefits of about $181,500 from flood prevention. Town Creek watershed project would provide 20 mgd water supply for downstream use. The Tonoloway Creek project would provide 12 mgd water supply, and Licking Creek would furnish 2 mgd water supply and about 8 cfs for water quality improvement. Developments on North Branch and Town Creek must be coordinated with the Corps of Engineers in view of that agency's interest in Bloomington and Town Creek Reservoirs.

A flood plain information study for Hagerstown would provide data which could enable planners to prepare a comprehensive land use plan and other development control measures resulting in more efficient use of the flood plain.

Sampling and studies by the FWPCA and State agencies indicate that largest contributions of acid to the Potomac River Basin come from areas which contain active mines. A program to sample mine effluents has not been undertaken and, since individual contributors are not known, an estimate of abatement costs is not possible. Additional field work and investigations must be continued to locate and characterize mine drainage discharges and formulate abatement measures and control programs which are technically and economically feasible.

The intent of subparagraph (b), Section 5, Public Law 90-542, should be implemented as soon as practical in regard to that portion of the Youghiogheny River which has been designated as a possible addition to the National Wild and Scenic Rivers System. A map and schematic diagram of the various alternatives considered are shown in Figure 4-8.

State Planning Sub-region 19 - West Virginia

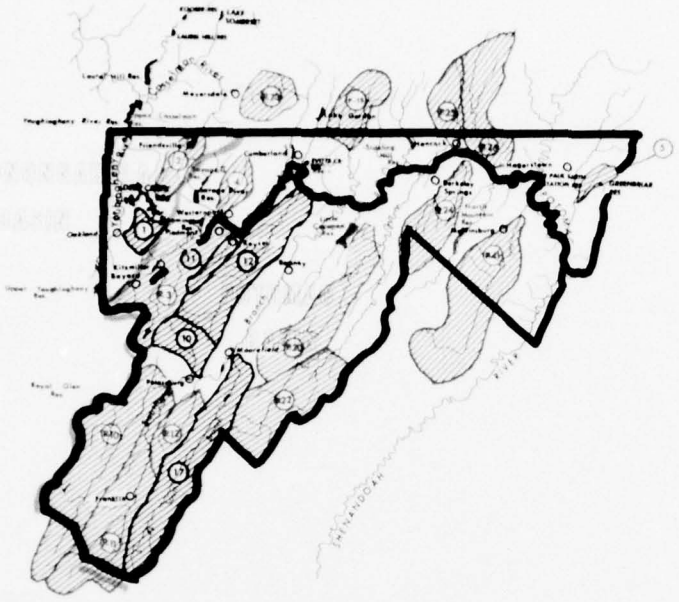
Bloomington Reservoir, as described in State Planning Sub-region 37, will provide reduction of flood damages at Piedmont and Keyser and also produce adequate flows to satisfy water supply needs at Keyser.

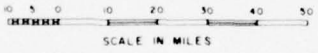
North Mountain and Little Cacapon Reservoirs have been recommended for authorization by the Chief of Engineers as elements in the comprehensive plan for development of the Potomac River. The projects would provide regulated releases to supplement natural stream flows to satisfy the estimated municipal and industrial water supply and quality demands for Metropolitan Washington. Areas adjacent to the projects would benefit from recreation and fishing opportunities which would provide facilities for an estimated visitation usage of 1,418,000 recreation days. The North Mountain and Little Cacapon projects would ultimately cost about $27,100,000 and $20,746,000 and would produce annual expansion effects of $995,000 and $419,000, respectively. Operation of the projects would be coordinated with the State of West Virginia.

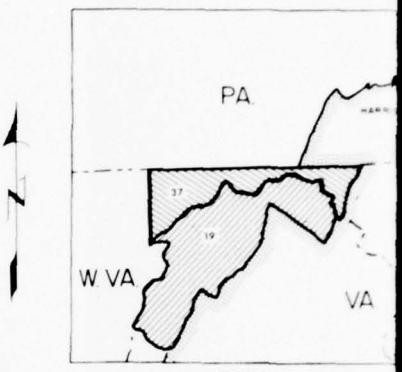
The Royal Glen Flood Control Project consisting of a reservoir and improved channel will provide flood protection from the 100-year flood at Petersburg and Moorefield and produce water surface to meet about 500,000 recreation days of the sub-regional demand. Approximately 500 acres of prime industrial land will become available by reducing the flood potential. The project is estimated to cost $29,080,000 and should provide expansion effects in the amount of $7,313,000 annually.

The Spruce Knob-Seneca Rocks National Recreation Area State Parks Complex, as described in the Appalachian Highlands Recreation Study, is included in the plan to provide recreation opportunities; however, further studies are necessary to determine total economic impact of the potential

Authorized upstream watershed developments on Lunice Creek, New Creek-White Run, Patterson Creek, and South Fork are included in the plan as measures to provide for rural and urban flood reductions and water supply. Lunice Creek would provide about $64,100 reduction of flood damage to residential and commercial improvements, roads, and railroads. The New Creek-White Run development would produce flood damage reductions of some $73,800 basically to residential and commercial improvements and furnish municipal and industrial water supply for 6,200 persons. The Patterson Creek and South Fork projects would provide $206,000 and $396,000 flood damage reductions, respectively, to residential and commercial improvements, roads, railroads, and agricultural lands. Patterson Creek would also furnish water supply to some 500 people. A map and schematic diagram of the various alternatives considered are shown in Figure 4-8.







VICINITY MAP

UPSTREAM WATERSHED PROJECT
IDENTIFICATION

EXPECTED TO EXIST BY 1980

1 Little Youghiogheny River
10 Lunice Creek
11 New Creek-White Run
12 Patterson Creek
17 South Fork

ALTERNATIVES AVAILABLE FOR PLANNING

2 Upper Casselman River
P-3 North Branch
4 Georges Creek
5 Little Beaver
P-10 North Fork South Branch
P-11 South Branch
P-12 Mill Creek
P-15 Town Creek

P-20 North River
P-22 Lost River

P-24 Sleepy Creek
P-25 Tonoloway Creek
P-26 Licking Creek
P-41 Opequon
P-73 Wills Creek

LEGEND

RIVER BASIN BOUNDARY
STATE PLANNING SUB-REGION BOUNDARY
APPALACHIAN REGION BOUNDARY

North Branch
Bayard

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR
UPSTREAM WATERSHED PROJECT
LFP PROJECT

PLANNING ALTERNATIVES

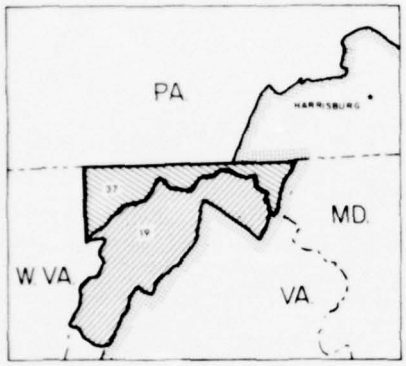
MAJOR RESERVOIR
UPSTREAM WATERSHED PROJECT
LFP PROJECT

STATE PLANNING SUB-REGION 37
MARYLAND

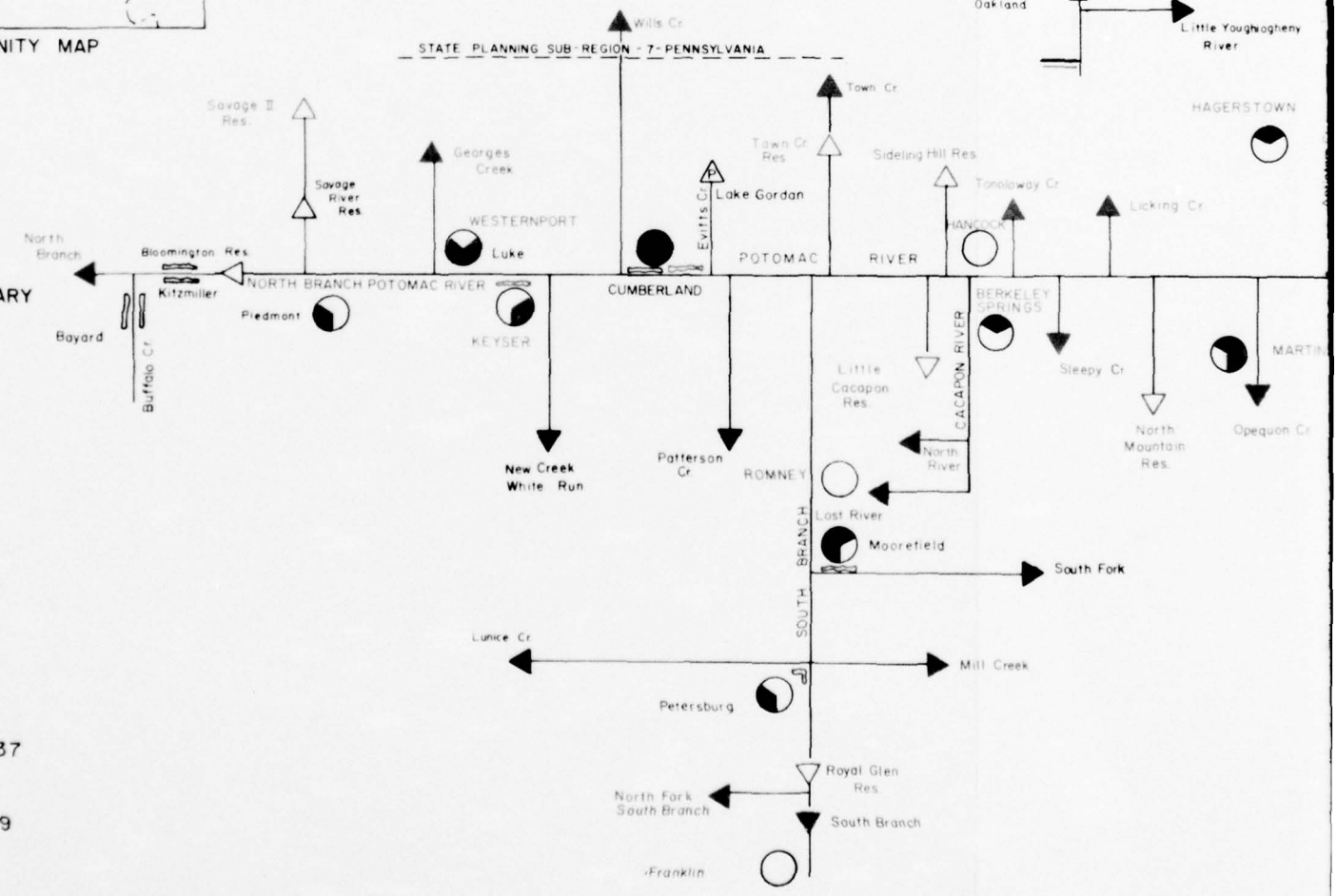
STATE PLANNING SUB-REGION 19
WEST VIRGINIA

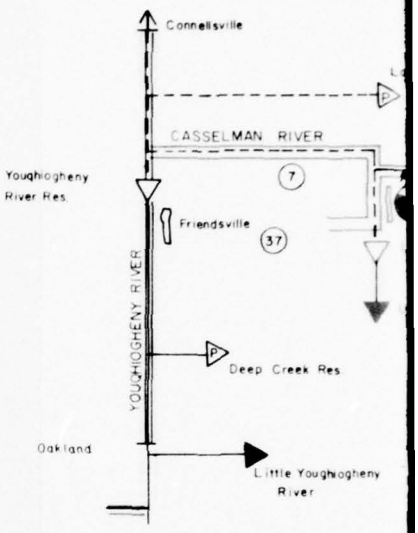
PRECEDING PAGE BLANK-NOT FILMED

LOCATION MAP



VICINITY MAP





IDARY
SUB-REGION BOUNDARY
ON BOUNDARY
980

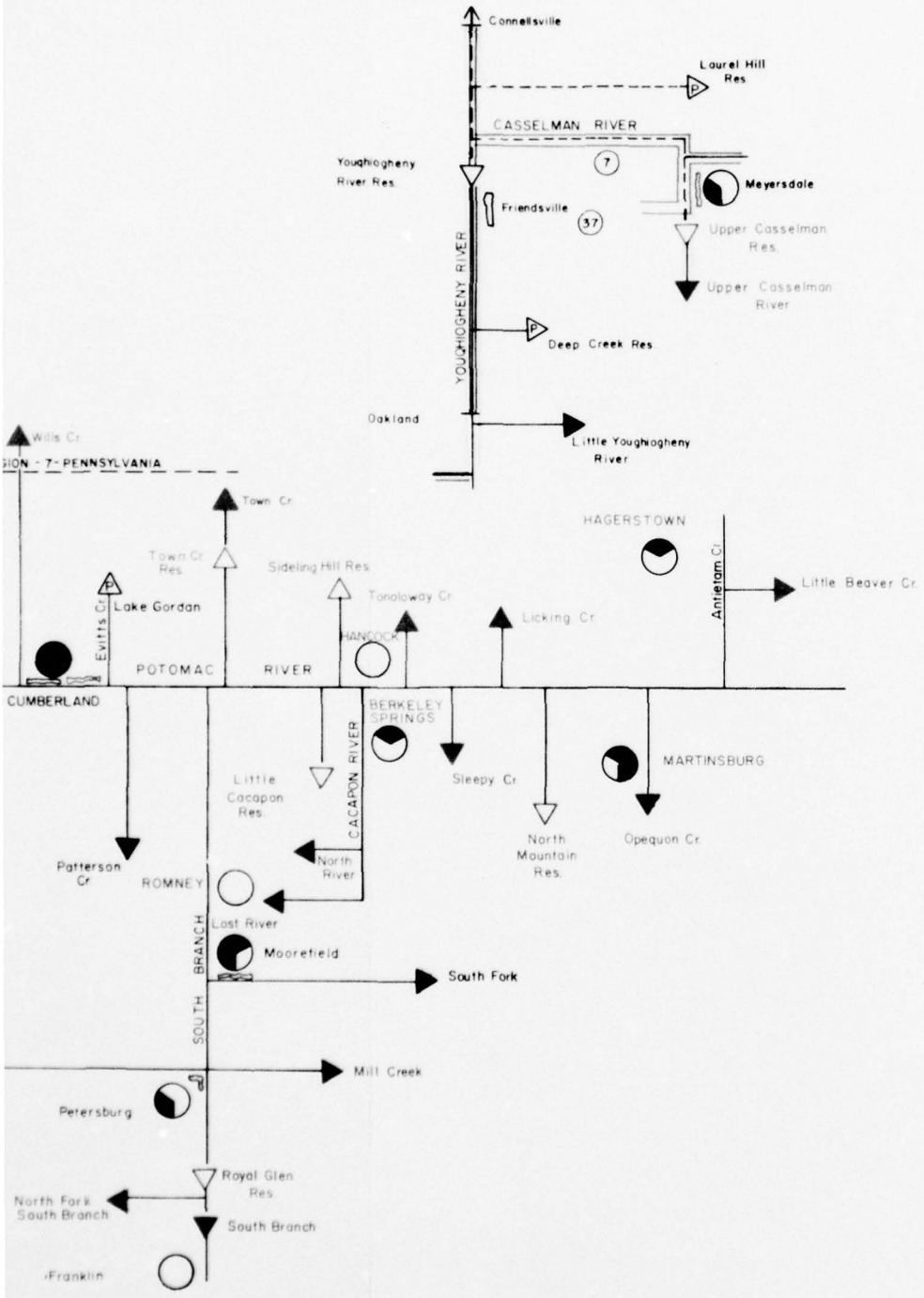
SHED PROJECT

SHED PROJECT

NNING SUB-REGION 37
MARYLAND

NNING SUB-REGION 19
EST VIRGINIA

TION MAP



LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR; P INDICATE NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- LFP PROJECT

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR; P INDICATE NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- LFP PROJECT

OTHERS

- SCENIC STREAM

TOWN NAME PRIMARY GROWTH CENTER
Town Name SECONDARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

- CONTINUOUSLY
- INTERMITTENTLY

STATE PLANNING SUB-REGION 37
MARYLAND

STATE PLANNING SUB-REGION 19
WEST VIRGINIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-4-85 FIGURE 4-8

B

LOCATION MAP

PRECEDING PAGE BLANK-NOT FILMED

12. SUMMARY OF PLAN

In this section, a plan for water resource development is presented that identifies projects needing acceleration of planning and construction, selected projects satisfying present and near future needs for which authorization is needed, and additional studies required to identify the water resource development needed to stimulate economic growth throughout the sub-region. Because of the status of many on-going water resource studies in Sub-region B, it is not possible to identify, at this time, a completed comprehensive water resource development plan that recommends implementation of specific projects and measures for solution of all the sub-region's water associated problems.

The program presented here for water resource development in Sub-region B has been divided into three components based on the status of water resource planning in the sub-region. The first component includes projects and measures for which implementation can commence without further authorization. Assuming proper funding, all of the authorized projects will be in place by 1980 and contributing significantly to the sub-region's economic development. The projects and measures identified in component II have been carefully studied and their economic impact recognized. However, they have not been authorized. Authorization should be obtained to allow installation of all structures and the carrying out of associated land treatment measures by 1990. The third component includes potential projects that may be identified in on-going studies and projects and program requiring further study.

COMPONENT I.

This component of the plan for water resource development includes high priority projects that are in advanced stages of planning which will have a strong and immediate effect on the sub-region's economy, land treatment measures that are urgently needed, and solution of the acid mine drainage problem.

Table 4-11 presents a list of high priority projects and measures included in this component of the plan. Their locations are shown on Figure 4-9.

TABLE 4-11
ELEMENTS OF COMPONENT I

1. Tioga-Hammond Reservoir, Pennsylvania
2. Cowanesque Reservoir, Pennsylvnaia
3. Davenport Center Reservoir, (Charlotte Creek Complex), New York
4. South Plymouth Reservoir, New York
5. Mine Drainage Control
   a. Tioga River and Tributaries, Pennsylvania
   b. Upper West Branch Susquehanna River, Pennsylvania
   c. Casselman River, Maryland and Pennsylvania
6. Raystown Reservoir, Pennsylvania
7. Foster Joseph Sayers Reservoir, Pennsylvania
8. Tyrone Local Flood Protection Project, Pennsylvania
9. Naturealm Conservation and Education Area, Pennsylvania
10. Bloomington Reservoir, Maryland and West Virginia
11. Upstream Watershed Projects
    a. Upper Five Mile Creek, New York
    b. Nanticoke Creek, New York
    c. Genegantslet Creek, New York
    d. Patterson Creek, New York
    e. Finch Hollow, New York
    f. Marsh Creek, Pennsylvania
    g. Mill Creek, Pennsylvania
    h. Martin Creek, Pennsylvania
    i. Middle Creek, Pennsylvania
    j. Briar Creek, Pennsylvania
    k. Little Youghiogheny River, Maryland
    l. Lunice Creek, West Virginia
    m. New Creek, West Virginia
    n. Patterson Creek, West Virginia
    o. South Fork, West Virginia
12. Land Treatment Measures
13. Treatment of Wastes at Their Source
14. Local Protection Project, Danville, Pennsylvania

Water Area B-1.

Planning and construction of several reservoir projects in Water Area B-1 that will help to stimulate economic activity should be accelerated. These include three Corps of Engineers' projects: Tioga-Hammond Reservoir and Cowanesque Reservoir in Pennsylvania, and South Plymouth Reservoir and Davenport Center Reservoir (Charlotte Creek Complex) in New York.

The Tioga-Hammond and Cowanesque Reservoir were discussed briefly in Section II. The estimated first costs are $57.5 million and $32.4 million, respectively. Flood control is the main purpose of these two reservoirs with both having recreation as a purpose. The flood control included in these reservoirs will provide additional protection to areas in downstream growth centers, particularly Corning and Elmira, New York that have potential for industrial, commercial, and residential development. In addition to the stimulus to the economy provided by flood protection, the recreation facilities for the Tioga-Hammond Reservoir will promote economic growth by creating a demand for new facilities and services to house, feed, entertain, and supply the needs of the visitors to the recreational area. Access to these project areas will be facilitated by construction of north-south Appalachian Corridor "U", which will connect with Corridor "T" in the Corning-Elmira area. Adequate transportation, together with flood protection and improved community and recreational services, would result in an environment suitably attractive to enhance industrial growth along the Chemung River.

Acceleration of planning and construction of the authorized Davenport Center Reservoir would stimulate the economy of downstream growth centers, such as Binghamton, Sidney, Oneonta, and Unadilla, New York. The Davenport Center Reservoir was authorized as a flood control project in the Flood Control Act of 28 June 1938. The project is now being studied by the State of New York as one element of the Charlotte Creek complex. It is also being considered for modification in the Susquehanna Survey Report Studies in order to make the project more responsive to the area's needs. The complex, as being studied, would consist of one or more impoundments on Charlotte Creek and tributaries having as purposes flood control, recreation, and storage for future water supply and water quality improvement. The recreation facilities would provide for an ultimate annual visitation of 400,000 people.

The South Plymouth Reservoir was authorized as a flood control project in the Flood Control Act of 1938. Under the Susquehanna Study it is being restudied for consideration under the plan for development in that Basin, with water supply, flood control, recreation and fishing as benefits. The City of Norwich will have water supply needs in the

future and this project is conveniently located to satisfy this future need. Flood control would be provided primarily at Norwich where ice jam floods are frequent, with additional benefits downstream as far as Athens, Pennsylvania. Recreation and fishing expansion benefits would be perhaps the most important results of this project.

A major problem in Water Area B-1 is acid mine drainage in Tioga County, Pennsylvania. The Tioga River is rendered acid by discharges from Morris, Coal, and Bear Runs. Preliminary information on a study of Morris Run indicates 72 abandoned deep mine openings, of which nine are discharging acid water, and 41 strip mines, five of which have acid discharges. Only two of the 41 strip mines and none of the deep mines are active. There are three major subsidence areas and four areas of major stream infiltration. In the 13.5 square mile study area, there are 16 major mine drainage discharges. Abatement of the problem in Tioga County would enhance the environment of the area and improve the quality of the water stored in the Tioga River portion of the Tioga-Hammond Reservoir thereby improving the recreation potential of the reservoir. Mine drainage abatement in the Tioga River watershed and construction of the Tioga Reservoir are given high priority by the Commonwealth of Pennsylvania, which estimated the first costs for abatement at $7.25 million.

Water Area B-2

Acceleration of planning and construction of several water resource projects in Water Area B-2 would provide short and long range stimuli to the region's economy. Completion of the Raystown Reservoir in Huntingdon County, Pennsylvania is vital to improving the economy in the water area. The effect this reservoir will have on the economy of the area is quite favorable and, therefore, its completion is imperative for economic growth. The purposes of this project and its effect on the area was discussed in Sections II and III of this report. Although the project is presently under construction, acceleration of funds for construction would be extremely beneficial. First cost for construction is estimated at $73 million.

Construction of the Foster Joseph Sayers Reservoir Project located on Bald Eagle Creek, Pennsylvania is nearly complete and will be operated in a system of completed reservoirs to reduce flooding along the Bald Eagle Creek and along the West Branch Susquehanna River below Lock Haven. Recreational development by both the Federal Government and local authorities will stimulate recreational activities in the area and will stimulate economic expansion in the tourist industry. The estimated first cost of the project is $28.1 million.

A local flood protection project is needed to stimulate the economy of Tyrone, Pennsylvania. Acceleration of an authorized project that will protect the business district of Tyrone from recurrent flooding is

vitally needed. An investigation of this project was conducted under this survey to determine if the project should be reformulated to provide additional economic stimulation. The studies revealed no need for alteration of the project, but did demonstrate that economic growth in Tyrone depends on completion of the flood protection facilities presently estimated to cost $13.1 million.

Acceleration of the Naturealm Project, a conservation and education area in Cambria County, Pennsylvania as described in Chapter 20, Part III of this report and also in the Pennsylvania State Supplement, would provide economic stimulation to the surrounding area. Naturealm is a multiple-purpose concept to use part of the existing reservoir in Prince Gallitzin State Park for cultural enrichment and economic development. The project, estimated by the Commonwealth to cost about $9.5 million, is a plan to use an existing water setting to maximize the economic potential of this scenic area where the economy has been depressed by losses of jobs in railroading, coal mining, steel manufacturing, and farming. This project will, directly or indirectly, create an estimated $10 million gross annual sales income. There is no doubt that the project will have a favorable impact on the economy of the surrounding area making acceleration of the project highly desirable.

The business district of Danville, Pennsylvania experiences flooding from backwater on Sechler's Run when there are high stages on the Susquehanna River. A flood protection project on Sechler's Run (currently in advanced planning stages by Pennsylvania's Department of Forests and Waters) could eliminate this problem, stimulate expansion, and make the area more attractive to prospective investors.

There are two areas in Water Area B-2 where mine drainage control is urgently needed. These are in the upper reaches of both the West Branch Susquehanna River, and the Casselman River. The abatement work needed in these areas includes reclamation of strip mined areas, mine sealing and grouting, and surface water diversion and treatment. The estimated first costs for the upper West Branch Susquehanna River and Casselman River are about $18.3 million, and $5 to $7 million, respectively. Pollution of the water area's streams due to acid mine drainage is one of the area's most pressing problems, and until this problem is solved, one of its most valuable resources will remain a bottleneck to economic growth.

Water Area B-3.

In Water Area B-3, the Bloomington Reservoir Project will provide for many of the area's water resource needs, as was discussed in Sections II and III of this report. To say this project is urgently needed is an understatement. The project is currently in the advanced

planning stage and is estimated to cost about $73.5 million. The completed project will provide flood protection to industrial development sites in the North Branch Valley and provide storage for low flow augmentation that can be released to satisfy both immediate and near future water supply and water quality needs at downstream areas. The importance of the project to satisfy water resource needs in downstream areas both in and out of Appalachia cannot be over-emphasized and, therefore, acceleration of this project is vital in that it will provide an early stimulus to the economy of the area which has been depressed for so many years. The drainage area of this project is also a source of mine drainage pollution, and although definitive data and costs are not available for the solution to the problem, a corrective program is urgently needed to complement the project.

Sub-region B.

Within Sub-region B, 15 watersheds have been identified by the Soil Conservation Service as being authorized for installation. The locations are shown on Figure 4-9. Additional information and data are contained in Appendix A.

In addition to meeting the most urgent conservation needs of the Sub-region, the U. S. Department of Agriculture recommends acceleration of land treatment and management programs for privately owned and National Forest lands. This acceleration will provide continued production of food and fiber and reduction of floodwater, erosion, and sediment damages. It will also increase outdoor recreational opportunities and improve the water and environmental quality of the sub-region. Priority will be given to critically eroding areas and the drainage areas above the recommended and existing water resource developments of the states, Corps of Engineers and others to improve their efficiency and useful life. The acceleration required is as follows:

1. Adequately treat and protect 304,600 acres of cropland, improve 230,300 acres of pasture and establish 66,900 acres of new pasture planting.

2. Revegetate and stablize critically eroding areas of 6,300 acres of roadbank and 31,500 acres of surfaced mined areas.

3. Increase recreational and fish and wildlife opportunities by the construction of 784 farm ponds, management of 1,500 farm ponds for fish production, construction of 274 miles of recreation access roads, development of 20,400 acres of wildlife habitat, plan for wildlife habitat preservation of 116,200 acres and develop 4,900 acres of picnic areas and 2,000 acres for camping areas.

4. Develop 13,700 basic conservation plans and complete detailed soil surveys on 2,252,100 acres.

Acceleration for state and private forest and woodland includes:

1. Plant 71,500 acres in trees.

2. Treat 660 acres for erosion control.

3. Treat 31,000 acres for hydrologic stand improvement, 29,500 acres of harvest cutting, and protect 41,300 acres from livestock grazing.

4. Develop 2,800 forest and woodland management plans.

Planned acceleration for National Forests is as follows:

	Acres
Tree Planting	28,000
Timber Stand Improvement	22,600
Water Yield:	
Improvement by Vegetative Management	10,000
Soil and Water:	
Gully Stabilization	10
Sheet Erosion Control	20
Streambank Stabilization	10
Stream Channel Clearing	10
Rehab. Abandoned Roads & Trails	20
Soil Survey	200,000
Watershed Analysis	150,000
Fish and Wildlife:	
Small Game Range Analysis	80,000
Wildlife Openings	2,100
Seeding and Planting	1,600
Release of forage plants	1,600
Stream and Lake Surveys	320
Range Management	1,700

The structural measures include: Construction of (a) one Fire Weather Station; (b) five miles of firebanks; (c) 100 acres of waterholes for wildlife and impoundments and potholes for waterfowl; (d) 315 acres of impoundments for recreation; (e) 700 acres of developments and 4 special projects for recreation; (f) 400 acres of roadside developments; (g) 19 miles of road and 24 miles of trails; (h) 7 observation sites; and (i) 2 bridges improvement of 400 acres of stream and lake habitat for fish and wildlife and acquisition of 7,200 acres of land.

With the projected increases in population and with many locations within the sub-region without adequate sewage treatment facilities, increased emphasis must be placed upon the planning and construction of municipal waste treatment facilities to provide at least secondary treatment of sewage. This degree of treatment is required to prevent degradation of stream quality and will in many instances enhance the water quality. A program for construction of treatment facilities has been implemented and many local subdivisions have sewage treatment facilities under construction. Continued emphasis by Federal, state, and local governments must be placed on this program.

The projects and programs contained in this component to the water resource development plan are of prime importance to Sub-region B. This part of the plan will give the initial stimulus to the sub-region's economy and, in a sense, will "start the ball rolling". Therefore, this component should receive major consideration so that some of the immediate water resource needs, that will also promote economic growth, can be fulfilled. Although there may be other projects and programs in the sub-region, particularly in the Susquehanna River Basin, that also could use acceleration, those identified here are considered to be urgently needed.

COMPONENT II.

This component of the plan for water resource development in Sub-region B includes high priority projects that will satisfy water resource needs and will stimulate the economy of the area, and for which authorization or approval is required. Projects in this component include most of those studied under the Appalachian Water Resource Survey. Table 4-12 presents a list of high priority projects and measures included in this component of the plan. The locations are shown on Figure 4-9.

TABLE 4-12
ELEMENTS OF COMPONENT II

1. Five Mile Creek Reservoir, New York
2. Mud Creek Reservoir, New York
3. Site 49-28, New York
4. Local Protection Project
   a. Delhi, New York
   b. Johnstown, Pennsylvania
5. Upstream Watershed Projects
   a. Marsh Ditch, New York
   b. Newtown-Hoffman Creek, New York
   c. Mill Brook, New York
6. Vacationscape Recreation Development, Pennsylvania
7. Royal Glen Reservoir, West Virginia
8. North Mountain Reservoir, West Virginia
9. Town Creek Reservoir, Maryland
10. Little Cacapon Reservoir, West Virginia
11. Sideling Hill Reservoir, Maryland
12. Upstream Watersheds Studied Under Potomac River Basin Study
    Maryland, Pennsylvania, and West Virginia.
    a. North Branch, Md.
    b. North Fork South Branch, West Virginia
    c. South Branch, West Virginia
    d. Mill Creek, West Virginia
    e. North River, West Virginia
    f. Lost River, West Virginia
    g. Sleepy Creek, West Virginia
    h. Tonoloway, Maryland
    i. Licking Creek, Maryland
    j. Opequon, West Virginia
13. Wills Creek Upstream Watershed Project

Water Area B-1.

In Water Area B-1, a local flood protection plan has been formulated for Delhi, in Delaware County, New York, on the West Branch Delaware River. The plan was formulated not only to reduce flood damages but to include economic development and recreation as project purposes. The project would protect most of the central part of the town. The project plan for flood protection consists of a combination of channel modification, levees, walls, and fill in low areas, along with attendant drainage structures, bridge modifications, and relocations or removal of existing structures in the project area. In addition to elimination of recurring flood damages the project would provide flood-free land that can be used for further development of the central business district and make possible an urban renewal program in areas now subject to the threat of flood. This project will be an important stimulant in the economy of the community consistent with the objectives of the Appalachian Water Resource Survey. The estimated first cost of the project is $1 million.

The projects identified on Five Mile Creek and Mud Creek located as tributaries to the Cohocton River upstream of the growth centers at Corning and Elmira would provide additional flood control protection to the downstream counties. In addition each reservoir would provide flow augmentation to meet future water supply and water quality needs projected to develop in the future. The recreation aspects of the projects would also meet a portion of the total recreation demand from the state planning area. The Mud Creek Reservoir would be located on Mud Creek about three miles upstream of its confluence with the Cohocton River. The Five Mile Creek Reservoir would be located on Five Mile Creek about two miles upstream of its confluence with the Cohocton River. These projects are presently being studied for inclusion in the plan for development of the water resources of the Susquehanna Basin under the Susquehanna Comprehensive Study.

Site number 49-28 is located on the West Branch Tioughnioga Creek, [illegible] miles upstream of Cortland, near the town of Fabius. Water resource needs of the Ithaca-Cortland area would be served by this project. Flood reduction would be accomplish from Cortland downstream to the Otselic River, and water quality would be served at Cortland. In addition, facilities would be constructed for 238,000 recreation days. This project is also being considered for the Susquehanna River Basin development plan.

There are three feasible upstream watershed projects in Water Area B-1 that have been studied under the PL-566 program of the Soil Conservation Service. These are Marsh Ditch in Allegheny and Steuben Counties, New York, Newtown-Hoffman Creek in Chemung and Schuyler Counties, New York, and Mill Brook in Chenango County, New York. Development of these watersheds will satisfy water resource needs in their respective areas which will promote economic development. The Soil Conservation Service has identified these projects as being high priority for accelerated planning. Additional data on these watersheds are located in Appendix A.

During investigations of water resource needs and of the economy of Sub-region B, it was recognized that the north-central section of Pennsylvania had an outstanding potential for development of recreational opportunities and that a comprehensive and orderly development of this region would lead to substantial economic growth. A report has been prepared ("Vacationscape") and included as an exhibit to this Chapter, presenting a framework and master plan for development of recreational activities for the study area. This report is the first phase of a detailed study that is needed to define a comprehensive plan for the development of the recreational potential of north-central Pennsylvania. Initiation of an intensive planning effort is needed at this time. The plan for creating a recreation complex in this area can be initiated by acquisition of lands for access highways and site preservation of potential development sites. A phase II study, as described in Component III, should also be initiated to identify an orderly plan for staged development of the area.

Water Area B-2.

A local flood protection project on Sam's Run in Johnstown, Pennsylvania would provide protection to the business district. The project would primarily involve channel improvement. Data on the Danville (Component I) and Johnstown Local Protection Projects are contained in Pennsylvania's State Supplement (Part IV, Main Report). Pennsylvania gives both projects top priority. In addition to these projects, there are numerous additional locations in the Susquehanna valley where flood protection is needed. These areas are currently under consideration in the Susquehanna Study.

Water Area B-3.

In Water Area B-3, the Royal Glen and North Mountain Reservoir Projects have been identified for early construction to achieve the objectives of the Appalachian Water Resource Survey. In addition, there are three other reservoirs, Town Creek, Little Cacapon, and Sideling Hill, in this area that need early implementation to satisfy water resource needs both inside and outside of the Appalachian Region.

The Royal Glen Reservoir would be located on the South Branch Potomac River, just downstream from the confluence of the North Fork and South Branch, and 3.6 miles due west of Petersburg in Grant County, West Virginia. At the damsite, the South Branch Potomac River has a drainage area of 640 square miles in forested valley and ridge terrain. The recreation pool would be at an elevation of 1,060 feet msl and have a water surface area of 1,150 acres. The reservoir at the recreation pool would extend 4.4 miles up the South Branch to within 8 miles of the Grant-Pendleton County boundary, and 2.8 miles up the North Fork to the vicinity of North Fork Gap. It will provide flood control that will reduce flooding in downstream communities and slack water recreation to help meet a major deficiency in this area. The flood protection provided by this project will help to alleviate one of the major bottlenecks to economic growth in the Petersburg area, where the prime sites for industrial development are located in the flood plain. In addition, the recreation facilities will stimulate the area's economy by encouraging development of facilities to service the visitors to the reservoir. The project construction cost is estimated to be $27.9 million, and represents a reformulation of the project presented in the 1963 Potomac River Basin Report. The presently proposed project, which is described in detail in Chapter 3 of Part III, is much smaller and does not conflict with the high value natural scenic and recreational features of the area.

The North Mountain Reservoir would be located on Back Creek in Berkeley County, West Virginia, 2.2 miles due south of Jones Springs and 2.3 miles northeast of Shanghai. West Virginia. At the damsite,

Back Creek has a drainage area of 231 square miles in forested valley and ridge terrain. The full conservation pool, at an elevation of 529 feet msl, would extend about 11 miles upstream to DeHaven in Frederick County, Virginia. The upper two miles of the reservoir is in Virginia, outside of the Appalachian boundaries. The North Mountain Reservoir is an element of the water and related land resources development plan recommended in the Potomac River Basin Report published in February 1963. The project will provide low flow augmentation storage for water supply and quality control needs in downstream areas, particularly the Washington, D.C. Metropolitan Area. It would also provide a high value recreation resource in eastern West Virginia that would draw visitors from the eastern metropolitan areas. This project would provide added income to this part of Appalachia from the facilities needed to service and house these people. The project is estimated to cost $27.1 million and is described in detail in the referenced Potomac River Basin Report.

The other three reservoirs in Water Area B-3 are Town Creek Reservoir located on Town Creek in Allegany County, Maryland; Little Cacapon Reservoir located on Little Cacapon River in Hampshire County, West Virginia; and Sideling Hill Reservoir located on Sideling Hill Creek in Allegany and Washington Counties, Maryland. These projects will enhance fishery opportunities along their respective streams below the dams, contribute to flow supplementation needs in the Washington Metropolitan Area for water supply and for maintenance of acceptable flow levels in the Potomac River below the area's water supply intake, and provide additional recreational opportunities which will further economic growth in the area surrounding the projects. These projects have been recommended by the Chief of Engineers as part of the Potomac River Basin plan for early construction. The estimated first costs of Town Creek, Little Cacapon, and Sideling Hill Reservoirs are $13.2 million, $19.4 million, and $13.6 million, respectively.

Sub-region B.

Investigations of upstream watersheds during the Potomac River Basin studies revealed potential physical development of 13 watersheds in the sub-region. Of these 13 watersheds, 10 are economically feasible. These watershed projects as identified in the 1963 Potomac River Basin Study would have storage for sedimentation, flood prevention, water supply, and water quality. They would regulate drainage areas totaling 511 square miles and the total storage would be 136,628 acre-feet. The Soil Conservation Service has identified these watershed improvements for acceleration of planning with no priority as to development. Data on these watersheds are located in Appendix A. An acceleration of planning for these watersheds would be desirable. The total estimated costs of implementing these watershed projects is $12.9 million.

COMPONENT III.

This component of the plan discusses potential water resource development that may be identified in river basin studies now underway, as well as those projects and programs requiring further study.

These studies will be discussed in respect to their objectives and the possible water resource needs and development that they may identify. Since these studies are not completed, a comprehensive plan with projects that satisfy both short range and long range needs is impossible to formulate at this time because of the possibility of preempting better projects not yet identified. Table 4-13 presents a list of projects and studies included in this component of the plan. Their locations are shown on Figure 4-9.

TABLE 4-13
ELEMENTS OF COMPONENT III

1. Projects for which additional studies are required when need is apparent.
   a. Savage II Reservoir, Maryland
   b. Mt. Storm Reservoir, West Virginia
   c. Tonoloway Creek Reservoir, Maryland and Pennsylvania
   d. Licking Creek Reservoir, Maryland and Pennsylvania
2. Completion of Susquehanna River Basin Study
3. Hawk Mountain Reservoir, Pennsylvania
4. West Branch Delaware River Watershed Project, New York
5. Upper Casselman Reservoir and Upstream Watershed Study, Maryland and Pennsylvania
6. Upstream Watershed Projects
   a. Stony Creek, Pennsylvania
   b. Georges Creek, Maryland
   c. Cayuga Inlet, New York
   d. West Br., Delaware R.
7. Tioughnioga Watershed Study, New York
8. Phase II of Vacationscape Recreation Development, Pennsylvania
9. Susquehanna Acid Mine Drainage Study

The recommendations of the 1963 Potomac River Basin Report has been reviewed and modified. The recommended plan in the report contained 16 major reservoirs with eight located in the Appalachian portion of the basin. However, the modified recommendations in the Chief of Engineers' Report, now being processed to the Congress, includes six major reservoirs, with four located in Appalachia. The report also recommends a program of headwater reservoirs and improved land treatment practices, and treatment of wastes at their sources to at least 80 percent biochemical oxygen demand (BOD) removal by 1985, and 85 percent by 2010. The 16 major reservoirs include Bloomington, North Mountain, Royal Glen, Sideling Hill, Little Cacapon and Town Creek Reservoirs which are included in Components I and II of this sub-region plan. Another of the 16 reservoirs, Savage II, located on the Savage River in Garrett County, Maryland was investigated under the Appalachian Water Resource Survey to determine if its early construction is needed. Studies revealed, however, that it would not require implementation until about 1995 and, therefore, the studies were discontinued under this survey. Studies on the project should be resumed when the need for its services becomes apparent. In addition, studies should resume on the Mt. Storm, Tonoloway, and Licking Creek Projects when the need for their service becomes apparent.

The Susquehanna River Basin Study is nearing completion. Water resource needs in the basin have been identified, and the three objectives of economic efficiency, regional development, and environmental quality were stressed in the plan formulation studies. Although there is some difference between the boundaries of the Susquehanna Study and the Appalachian Region, the economic projections for the Susquehanna Study and benchmarks for the Appalachian Study are basically the same. Since the water resource needs of the Susquehanna River Basin are based on these projections, a plan that satisfies these needs will also satisfy the Appalachian objectives for that portion of the basin. Since regional development is one of the prime objectives of the study, the final plan will include satisfaction of water resource needs that meet Appalachian objectives. All types of structural and non-structural alternatives are being considered in the study, and a brief discussion of alternative means of satisfying water resource needs is provided in Sections II and III of this report. The comprehensive plan resulting from this study will also include satisfaction of needs in the Susquehanna River Basin portions of Sub-regions A and F. Since the final comprehensive plan has not yet been formulated, specific projects in the plan that will satisfy all the water resource needs and stimulate the economy cannot be included in the plan being presented for Sub-region B.

It does appear, however, that the plan will include recommendations for reservoir projects both large and small, local flood protection projects, interceptor sewers, development of well fields, watershed treatment, advanced waste treatment, flood plain management, mine drainage abatement programs, and other structural and non-structural measures.

The plan presented in the Delaware River Basin Report of December, 1960 included only the Hawk Mountain Reservoir and two upstream structures in the West Branch Delaware River watershed in Sub-region B. The Hawk Mountain Reservoir was proposed for water supply, hydroelectric power, and recreation. As a result of the project screening during the early phases of the Appalachian Survey, this project was assigned to the Philadelphia District of the Corps of Engineers for survey scope study. Studies of the reservoir indicated that due to the high cost of relocations the reservoir is not economically feasible at this time and studies were discontinued. However, additional studies will be required in the future to re-evaluate the reservoir in the light of changing conditions.

The Forest Service and Soil Conservation Service have recently completed a general investigation of the West Branch Delaware River watershed. As a result of that investigation, a plan was formulated to be responsive to existing needs for urban and rural flood and erosion control, and to desires of local interests for development of multi-purpose impoundments for flood control, recreation, and water supply (flow augmentation). The findings indicate that, although the flood control features of this type of project are not economically justified, further detailed study is necessary to fully determine benefits attributable to the recreation and water supply features. Since continuing progress in building the Interstate Highway network is rapidly placing the impressive potential outdoor recreation resources of Delaware County within easy reach of metropolitan New York and Philadelphia, further studies with a view toward obtaining maximum economic benefits from the expanding outdoor recreation market, and preservation of the natural recreation resources in the area should be undertaken. A recreation complex, located in Delaware and Otsego Counties, New York, was studied by the Appalachian Regional Commission in their Appalachian Highlands study. This complex, designated as Delhi-Otsego-Cooperstown, was recommended for detailed study. It is estimated that a survey scope investigation and report on the subject could be completed in about 1 year, at a cost of about 60,000 dollars.

The portion of the Ohio River Basin that lies within the sub-region is reported on in the Sub-region F Report which contains a discussion or potential projects that will satisfy water resource needs and will stimulate the area's economy.

The Upper Casselman Reservoir has been identified as a potential Corps of Engineers project. In addition, the Department of Agriculture's Soil Conservation Service has studied an upstream watershed plan. The State of Maryland and the Commonwealth of Pennsylvania (in their state supplement) have indicated an interest in these projects as means of meeting needs within their respective states. Further studies as requested by the Commonwealth of Pennsylvania, are required to identify specific projects and measures which should be developed to meet the identified needs in this portion of the sub-region.

The Commonwealth of Pennsylyania identified the Stony Creek Watershed development as a high priority study in their State Supplement. The implementation of this program will provide flood control and recreational facilities within the basin and will produce additional business activity in the small towns throughout the area. The estimated cost of the program is $7.8 million, and consists of three dams and land reclamation. In addition to the aforementioned watershed project, the Soil Conservation Service has recommended that additional studies be made on the Georges Creek, Maryland and Cayuga Inlet, New York projects.

The State of New York indicates in its State Supplement that a comprehensive study of the Tioughnioga River Watershed is desirable to develop an upstream program of small reservoirs for the multiple-purposes of water supply, water quality, and flood control. The needs, and methods of satisfying the identified needs, are presently being investigated in the Susquehanna Study, and a comprehensive plan to meet the needs will be developed. Until this study is completed and a plan developed, specific project studies are not indicated at this time. If, however, during or after completion of the study, the need for additional studies is indicated, recommendations will be made to initiate such studies. They also desire that further study be made to determine whether upstream improvements are feasible in the West Br., Delaware River.

The "Vacationscape" recreation study for north-central Pennsylvania concluded that intensive year-round recreation development in the study area was desirable since the area offers an excellent potential for this type of investment. The next step in the planning progress is to conduct a Phase II study to identify the specific locations where recreational facilities should be constructed, and to develop other specific details of the sites, including cost-benefit analysis and recommendations for authorization of projects. This study would be conducted by the Corps of Engineers in close cooperation with state and local agencies so that the final plan would be compatible with state and local development plans.

The Appalachian Highlands Study, made by the Appalachian Regional Commission, identified the existing recreation complexes and recommended additional complexes for detailed study. These recreational areas are identified as "Terminal Complexes" in Phase I of their study, completed in August 1968.

One terminal complex, recommended for detailed study, is located in Tioga and Bradford Counties and is designated as "Susquehanna-North Tier". The other terminal complex located in the "Vacationscape" area, is the existing Otocsin-State Forests recreation complex located in Clearfield, Cameron, Potter, and Clinton Counties.

Other terminal complexes located in Sub-region B are Delhi-Otsego-Cooperstown, located in Otsego and Delaware Counties, New York; Raystown-State Park located in Centre, Huntingdon, and Mifflin Counties, Pennsylvania; Deep Creek-Laurel Mountain Interstate located in Fayette and Somerset Counties, Pennsylvania, and Garrett County, Maryland; and Spruce Knob-Seneca Rocks located in Tucker, Grant, Randolph, and Pendleton Counties, West Virginia.

There is an authorized Corps of Engineers study for the purpose of consolidating all data available from previous studies and developing a detailed plan to eliminate mine drainage pollution of streams within the Susquehanna Basin. The need for a plan to eliminate the problems arising from acid mine drainage has long been recognized, and previous studies have clearly identified the scope and magnitude of the problem and the sources of acid pollution. The Susquehanna River Basin Study Mine Drainage Study will identify the problem areas in detail, determine the specific sources of mine drainage pollution, and will study and identify measures which will reduce, and, in some locations, virtually eliminate the problem. A detailed plan for prevention and elimination of the mine drainage problem throughout the Susquehanna Basin will be formulated. The objective of the plan will be to restore presently acid streams to a higher quality which will increase the use of these streams for municipal and industrial water supply, and also increase their value for fish and wildlife and water contract recreation.

13. ADEQUACY

When the plan presented in the preceding paragraphs has been fully implemented, the water resource needs which have been identified and were presented in Sections II and III will have been substantially satisfied and the constraints imposed upon the economic development of the sub-region due to underdeveloped or undeveloped water resources will be removed. Although this program of water resource development will not in itself stimulate the overall economic effect necessary for the sub-region to attain the benchmarks, it will, in concert with all other Federal, state, and local programs, contribute greatly to the the economic development required to improve the well being of the people within the region. It must also be emphasized that in order for any plan to be successful, planning must be accomplished as a continuing effort to update needs and to continually re-evaluate the alternatives available to meet these needs.

Implementation of Component I of the plan will satisfy a portion of the needs identified in Sections II and III. Construction of the Cowanesque and Tioga-Hammond Reservoirs will reduce flood damages at the primary downstream growth centers of Elmira and Corning, in addition to smaller downstream communities along the Tioga and Chemung Rivers. The estimated average annual flood reduction benefits are $3,160,000 and $4,900,000 respectively. In addition, a portion of the total recreation

demand in this part of the sub-region will be met by the provision of recreation facilities at Tioga-Hammond. The estimated ultimate visitation is 700,000. The Davenport Center project (Charlotte Creek Complex) will reduce average annual flood damages by $630,000 along Charlotte Creek and the Susquehanna River from the project downstream to Athens, New York. The primary growth centers which will be provided flood reduction will be Oneonta, Sidney, and Binghamton. The communities along the Susquehanna from Conklin to Vestal are a portion of a growth complex which has high potential for further industrial development. Flood protection for this complex will result in an increase in the economic activity of this area. In addition to flood protection, the Davenport Center Project provides storage to meet a portion of the future water supply and water quality needs which were presented for the Binghamton Metropolitan Area. The project will also meet a portion of the sub-region's recreation demand by providing a recreation pool and facilities to accommodate an ultimate annual visitation of 400,000 people.

The mine drainage abatement programs for the Tioga and the upper West Branch Susquehanna River and the Casselman River will greatly reduce mine drainage pollution. The removal of this problem and the upgrading of stream quality which will result will greatly enhance the environment of these areas by opening up these streams to recreational activities presently not available and will provide water of a quality which can be used for municipal and industrial water supply. These programs will have a far reaching effect upon the economy of the area by enhancing the overall environment and making it more attractive for recreational and industrial development. Not only will the upgrading of water quality in the streams increase recreational activity, but the quality of water impounded in recreational pools downstream will also be increased and further enhance their use.

The Foster Joseph Sayer Project, presently under construction and scheduled for completion in 1970, provides for flood control and recreation. When completed, it will become an important component in a system of reservoirs composed of Curwensville, Kettle Creek, and George B. Stevenson, the latter constructed by the Commonwealth of Pennsylvania. When operated as a system, these reservoirs will provide additional flood reduction at the primary growth centers along Bald Eagle Creek and downstream along the West Branch Susquehanna River to its confluence with the main stem. The flood control benefits are estimated at $1,678,000. Recreation facilities will provide recreation opportunities for an estimated ultimate annual visitation of 650,000 people.

The Naturealm Conservation and Education Area presently being developed by the Commonwealth of Pennsylvania will contribute greatly to the preservation of the natural environment of this area in addition to providing an educational area. The project, when complete, will provide employment for about 438 persons and will generate an additional

1,770 jobs in tourist associated industry. This project will greatly enhance the economic growth of Johnstown and Altoona.

The Bloomington Reservoir Project will reduce flood damages along the Potomac River by about 42 percent. The primary growth centers protected by the project are Luke, Maryland and Keyser, West Virginia. The average annual flood control benefits are estimated to be $921,000. The project also provides for water supply needs at Luke, Maryland by increasing the dependable flows in the river.

Component II of the plan includes projects which require authorization. The specific reservoir projects include Royal Glen, North Mountain, and Little Cacapon Reservoirs, West Virginia; and Town Creek and Sideling Hill Reservoirs, Maryland. The Royal Glen project will provide storage for flood control and recreation. The project will reduce flood damages in the South Branch Valley at the primary growth centers of Petersburg, Moorefield, and Romney, West Virginia. The project will reduce flood damages at Petersburg where flooding has been identified as a serious constraint to economic expansion. The average annual flood control benefits are $733,300. In addition, the project will provide a needed slackwater pool for recreation and will provide recreational opportunities for an ultimate annual visitation of 480,000 people. Additional information on the project is presented in Chapter 3, Part III.

The North Mountain, Town Creek, Sideling Hill, and Little Cacapon Reservoir Projects are a part of a system of reservoirs designed for flow supplementation in the Potomac River at Washington D.C., for water supply, and for preservation of stream environment. These projects are designed to meet immediate needs in the Washington Metropolitan Area. In addition, they will provide recreation facilities which will stimulate economic development in the towns near the projects. These projects have been recommended by the Chief of Engineers in connection with his report to Congress on the 1963 Potomac River Basin Report. The total ultimate annual visitation at these sites is estimated at approximately 2,500,000 people. These recreation areas will help satisfy the recreation demand in Water Area B-3. Additional information on the North Mountain Reservoir Project is contained in the report of the Chief of Engineer , subject: Potomac River Basin, Maryland, Virginia, West Virginia, Pennsylvania, and District of Columbia, now being processed to the Congress.

Emphasis has been placed in the preceeding two paragraphs on the effects of the identified structural means of meeting immediate needs. The implementation of these measures is only part of a complete comprehensive water resource development plan. Perhaps the most important component to the plan is the need for continuous planning, to not only define a basic plan of development, but to continually review old

plans in the light of changing needs and developments in technology which make new alternatives available. It is important to realize that the first step in the planning process is a comprehensive study to develop a plan which is the basis for future revision, necessitating a plan that is responsive to the projected needs, but which can be modified as needs and alternatives to meet the needs change.

Other elements included in each component of the plan are watershed projects at various stages of planning. Implementation of those already authorized and accelerated planning on identified feasible projects is necessary to realize the local benefits from these programs. The impacts of each of these watershed projects are presented in Appendix A.

Mine drainage abatement measures are another important element in the total plan. Certain measures have been identified by both Federal and state representatives as being critically needed. There is, however, a need for continued planning in this area to ultimately remove all acid mine drainage in order to enhance the quality of the streamflow for recreational activities, as well as for municipal and industrial water supply.

A study of mine drainage problems in the Susquehanna River Basin has been authorized. It is anticipated that this study will identify sources of mine drainage pollution, determine the magnitude of the pollution caused by each source, recommend procedures for elimination of this pollution, and establish priorities under which scheduling of remedial measures can be made. A part of the study would also be such conservation measures as would contribute to the elimination of the problem. The study would be conducted by the Corps of Engineers in cooperation with the Department of Agriculture, the Department of Interior and its pertinent agencies, the Department of Health, Education and Welfare, and the appropriate agencies of the affected states. As the study is now planned, it will concern only the Susquehanna River Basin. However, consideration should be given to extending the study to include the Delaware and Schuylkill Rivers and tributaries of the Ohio and Potomac Rivers where the problem is also of significance. This study also encompasses the portion of the Susquehanna Basin in Sub-region A. Recommendations for expanding this study is contained in that Sub-region Report.

14. IMPLEMENTATION

The implementation of the plan will be the responsibility of governmental bodies at all levels. The agencies responsible for implementing the major elements of the plan are presented in Table 4-14.

Continued water resource planning at all levels of government is required, and coordination of the planning effort is essential so that plans can be developed that are responsive to all levels of needs.

TABLE 4-14
IMPLEMENTATION OF THE PLAN

Element	Responsibility
COMPONENT I	
Secondary Treatment of Wastes	Municipalities, industries, and other local interests concerned
Land Treatment Measures	Local Interests with technical aid from Department of Agriculture
Mine Drainage control	Industry, States, and Federal Government
Upstream Watershed Projects	Local Interests and Soil Conservation Service
Naturealm Conservation and Education Area	Commonwealth of Pennsylvania
Tioga-Hammond Reservoir	Corps of Engineers
Cowanesque Reservoir	Corps of Engineers
Davenport Center Reservoir	Corps of Engineers
Raystown Reservoir	Corps of Engineers
Bloomington Reservoir	Corps of Engineers
Blanchard Reservoir	Corps of Engineers
Tyrone Local Protection Project	Corps of Engineers
Danville Local Protection Project	Commonwealth of Pennsylvania
COMPONENT II	
Upstream Watershed Projects	Local Interests and Soil Conservation Service
Recreation Development for North-Central Pennsylvania	State and Federal Government
Royal Glen Reservoir	Corps of Engineers
North Mountain Reservoir	Corps of Engineers
Town Creek Reservoir	Corps of Engineers
Little Cacapon Reservoir	Corps of Engineers
Sideling Hill Reservoir	Corps of Engineers
Delhi Local Protection Project	Corps of Engineers
Johnstown Local Protection Project	Commonwealth of Pennsylvania
COMPONENT III	
Upstream Watershed Projects	Local Interests and Soil Conservation Service
Completion of Susquehanna River Basin Study	Local, State, and Federal Agencies
Reservoir Projects in Potomac River Basin	Corps of Engineers
Hawk Mountain Reservoir	Corps of Engineers
South Plymouth Reservoir	Corps of Engineers
Flood Plain Management	Counties and States with technical aid from Corps of Engineers

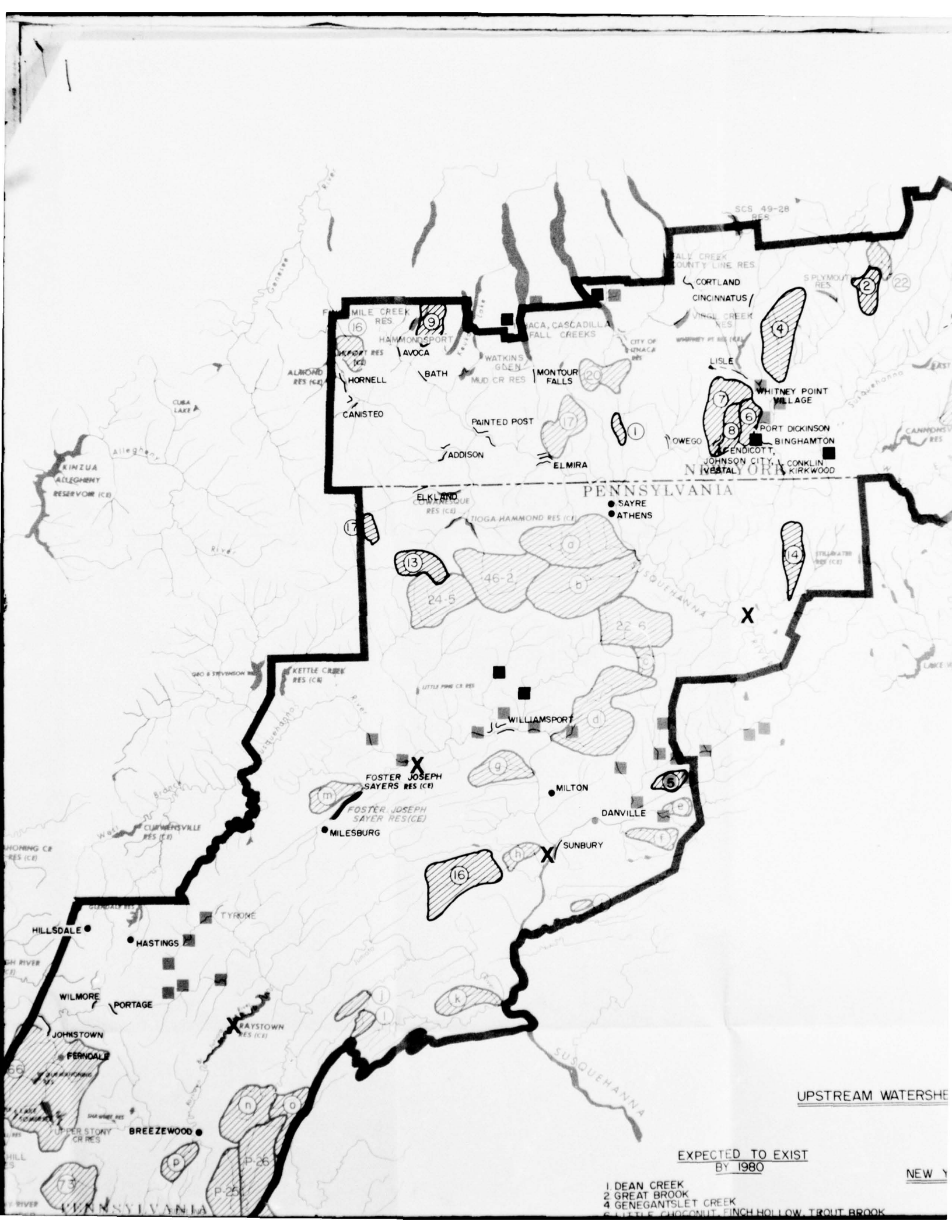
15. COSTS, BENEFITS, AND INDICES

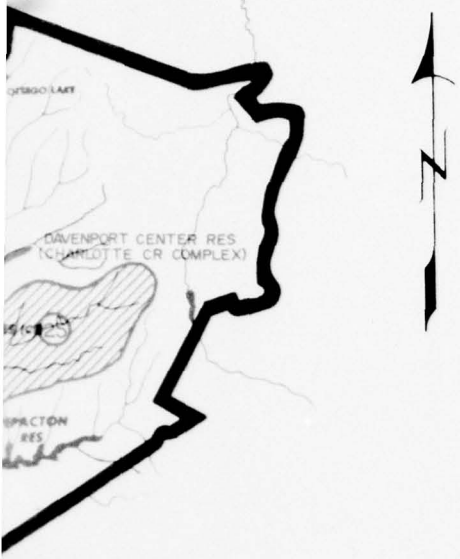
The costs, benefits, and users indices for the three components of the plan of development described in the preceding paragraphs, are shown in Table 4-15.

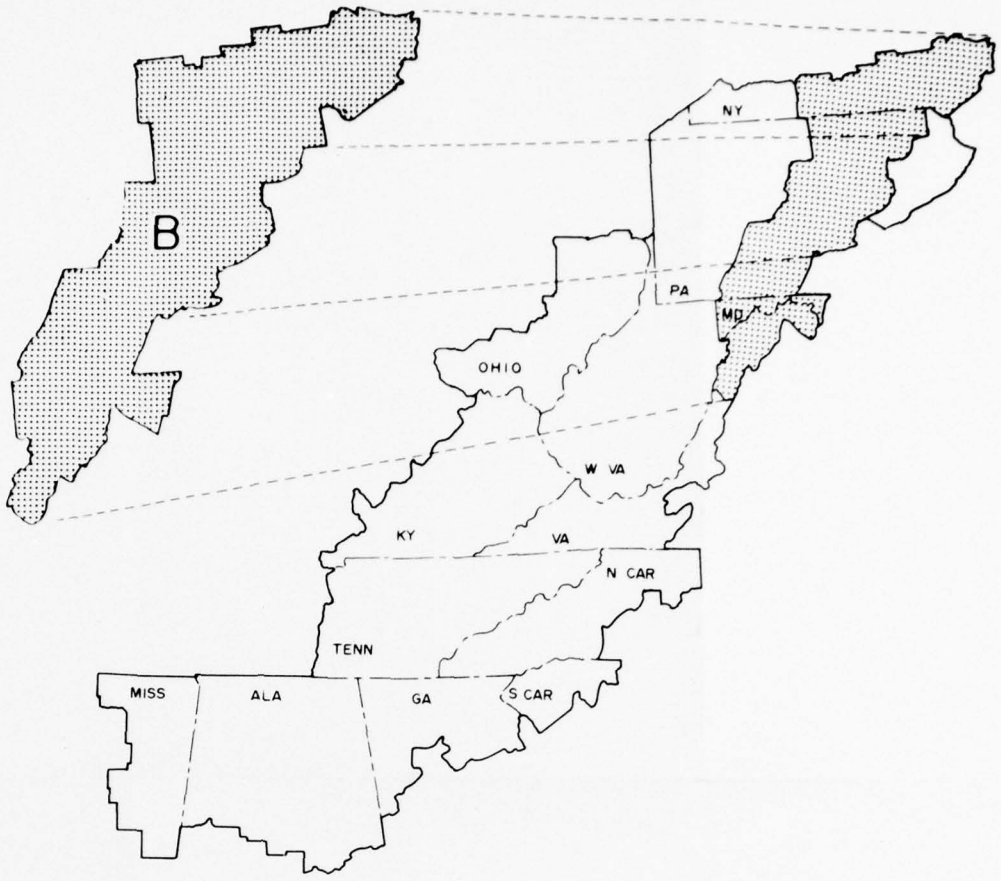
TABLE 4-15
COSTS, BENEFITS, and INDICES

Item	Cost $1,000	Annual Cost $1,000	Annual Benefit $1,000	B-C Ratio
Component I				
Tioga-Hammond Res.	57,500	2,255	5,855	2.6
Cowanesque Res.	32,400	1,253	3,375	2.7
Davenport Center Res.	31,830	1,264	1,568	1.2
Mine Drainage Control				
Tioga River	7,250*	-	-	-
Upper W. Br. Susquehanna R.	18,300*	2,040	975	
Casselman R.	7,000- 8,000*	-	-	-
Raystown Res.	55,100	2,595	3,415	1.3
Tyronne LPP	13,100	504	735	1.5
Naturelm	9,500*	-	-	-
Bloomington Res.	73,500	2,770	4,589	1.7
Blanchard Res.	28,100	1,283	2,783	2.2
Upstream Wtrshd Proj.	28,522	-	1,839	-
Land Treatment	-	4,527	15,607	-
Component II				
Delhi LPP	1,090	45	47	1.04
Upstream Wtrshd Proj.				
Marsh Ditch	580	-	28	-
Newtown-Hoffman Cr.	4,907	-	307	-
New Berlin	415	-	32	-
Royal Glen Res.	27,870	1,139	1,636	1.4
North Mountain Res.	27,100	1,175	1,878	1.6
Town Creek Res.	14,900	664	1,151	1.7
Little Cacapon Res.	20,700	856	946	1.1
Sideling Hill Res.	14,800	626	886	1.4
Upstream Wtrshds				
Potomac Basin	14,667	508	170	-
Component III				
Danville LPP	1,150*		-	3.0*
Johnstown LPP	320*		-	-

* From Pennsylvania state supplement


SCS 49-28 RES
CORTLAND
CINCINNATUS
MILE CREEK RES
HAMMONDSPORT
AVOCA
WATKINS GLEN
MUD CR RES
MONTOUR FALLS
BATH
HORNELL
CANISTEO
PAINTED POST
ADDISON
ELMIRA
LISLE
WHITNEY POINT VILLAGE
PORT DICKINSON
BINGHAMTON
ENDICOTT
JOHNSON CITY
CONKLIN
KIRKWOOD
OWEGO
VESTAL
NEW YORK
PENNSYLVANIA
SAYRE
ATHENS
ELKLAND
TIOGA HAMMOND RES (CE)
KINZUA ALLEGHENY RESERVOIR (CE)
KETTLE CREEK RES (CE)
WILLIAMSPORT
FOSTER JOSEPH SAYERS RES (CE)
FOSTER JOSEPH SAYER RES(CE)
MILTON
DANVILLE
MILESBURG
SUNBURY
CURWENSVILLE RES (CE)
TYRONE
HILLSDALE
HASTINGS
WILMORE
PORTAGE
JOHNSTOWN
FERNDALE
RAYSTOWN RES (CE)
BREEZEWOOD
UPPER STONY CR RES
SUSQUEHANNA
UPSTREAM WATERSHE
EXPECTED TO EXIST
BY 1980
NEW Y
1 DEAN CREEK
2 GREAT BROOK
4 GENEGANTSLET CREEK
6 LITTLE CHOCONUT, FINCH HOLLOW, TROUT BROOK





VICINITY MAP

STRUCTURAL

STATE RECREATION AND/ OR FISHING LAKE:

X SURFACE AREA IN EXCESS OF 200 ACRES

UPSTREAM WATERSHED PROJECT

(2) EXPECTED TO EXIST BY 1980

(n) FOR CONTINUING PLANNING

MAJOR RESERVOIR

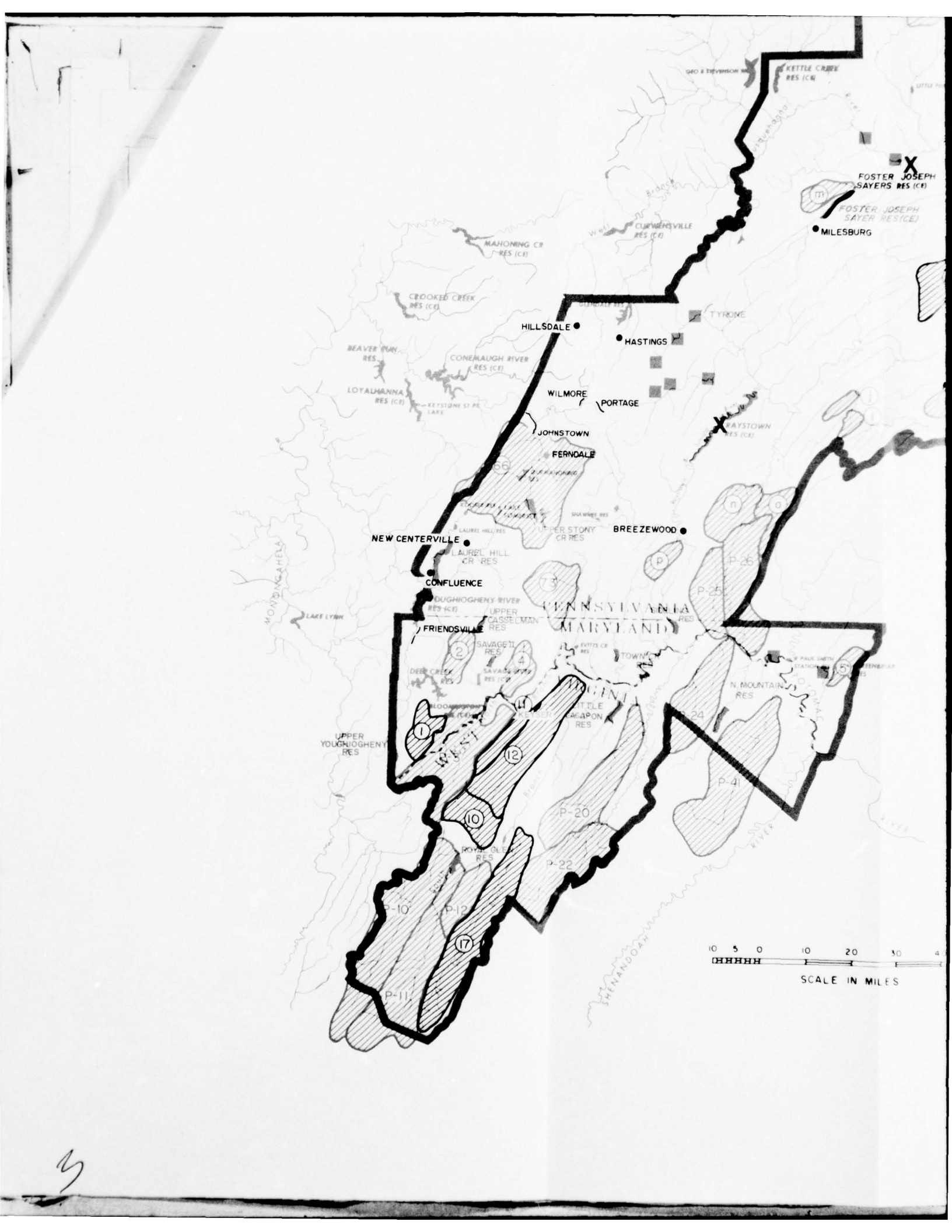
EXPECTED TO EXIST BY 1980

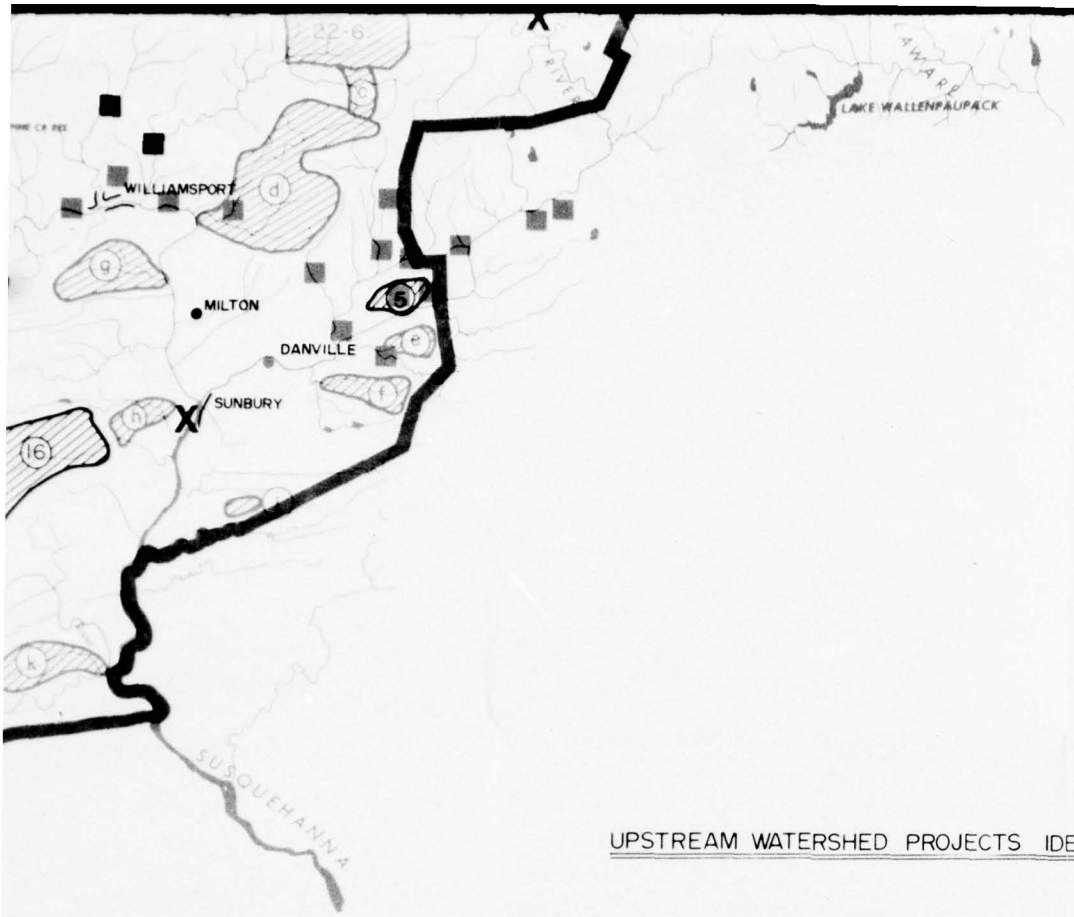
FOR CONTINUING PLANNING

OJECTS IDENTIFICATION

FOR CONTINUING PLANNING

16. MARSH DITCH
17. NEWTOWN - HOFFMAN CREEK


KETTLE CREEK RES (C#)
FOSTER JOSEPH SAYERS RES (C#)
FOSTER JOSEPH SAYER RES(C#)
MILESBURG
CURWENSVILLE RES (C#)
MAHONING CR RES (C#)
CROOKED CREEK RES (C#)
TYRONE
HILLSDALE
HASTINGS
BEAVER RUN RES
CONEMAUGH RIVER RES (C#)
LOYALHANNA RES (C#)
KEYSTONE ST PK LAKE
WILMORE
PORTAGE
RAYSTOWN RES (C#)
JOHNSTOWN
FERNDALE
SHADE CR RES
LAUREL HILL RES
UPPER STONY CR RES
BREEZEWOOD
NEW CENTERVILLE
LAUREL HILL CR RES
CONFLUENCE
MONONGAHELA
LAKE LYNN
YOUGHIOGHENY RIVER RES (C#)
UPPER CASSELMAN RES
PENNSYLVANIA
MARYLAND
FRIENDSVILLE
SAVAGE II RES
SAVAGE RIVER RES (C#)
DEEP CREEK RES
N. MOUNTAIN RES
WEST
UPPER YOUGHIOGHENY RES
P-41
P-20
P-22
P-10
P-12
P-11
SHENANDOAH
10 5 0 10 20 30
SCALE IN MILES



UPSTREAM WATERSHED PROJECTS IDENTIFICATION

EXPECTED TO EXIST BY 1980

NEW YORK

1. DEAN CREEK
2. GREAT BROOK
4. GENEGANTSLET CREEK
6. LITTLE CHOCONUT, FINCH HOLLOW, TROUT BROOK
7. NANTICOKE CREEK
8. PATTERSON, BRIXIUS, GREY CREEKS
9. UPPER FIVE MILE CREEK

PENNSYLVANIA

5. BRIAR CREEK
13. MARSH CREEK
14. MARTIN CREEK
16. MIDDLE CREEK
17. MILL CREEK

10. LUNICE CREEK
11. NEW CREEK - WHITE RUN
12. PATTERSON CREEK
17. SOUTH FORK

MARYLAND

1. LITTLE YOUGHIOGHENY RIVER

FOR CONTINUING PLANNING

NEW YORK

16. MARSH DITCH
17. NEWTOWN - HOFFMAN CREEK
20. CAYUGA INLET (ENFIELD)
22. MILL BROOK
25. WEST BRANCH DELAWARE RIVER

PENNSYLVANIA

a. SUGAR CREEK
b. TOWANDA CREEK
c. LARRUS CREEK
d. MUNCY CREEK
e. TRIBUTARY OF CATAWISSA CREEK
f. TRIBUTARY OF ROARING CREEK
g. TURTLE CREEK
h. PINE CREEK
i. TRIBUTARY OF MAHANTANGO CREEK
j. TRIBUTARY OF TUSCARORA CREEK
k. LITTLE JUNIATA CREEK
l. GEORGE CREEK
m. BIG RUN
n. SIDELING HILL CREEK
o. LITTLE AUGHWICK CREEK
p. CHAPMAN RUN
2. UPPER CASSELMAN RIVER
22-6. LITTLE LOYALSOCK CREEK
24-5. BABB CREEK
46-2. UPPER TIOGA RIVER
66. STONY CREEK
73. WILLS CREEK

WEST VIRGINIA

P-3 NORTH BRANCH
P-10 NORTH BRANCH SOUTH FORK
P-11 SOUTH BRANCH
P-12 MILL CREEK

P-20 NORTH RIVER
P-22 LOST RIVER

P-24 SLEEPY CREEK
P-41 OPEQUON CREEK
P-73 WILLS CREEK

MARYLAND

2 UPPER CASSELMAN RIVER
4 GEORGES CREEK
5 LITTLE BEAVER

P-25 TONOLOWAY CREEK
P-26 LICKING CREEK

VICINITY MAP

STRUCTURAL

STATE RECREATION AND/ OR FISHING LAKE:

X SURFACE AREA IN EXCESS OF 200 ACRES

UPSTREAM WATERSHED PROJECT

EXPECTED TO EXIST BY 1980

FOR CONTINUING PLANNING

MAJOR RESERVOIR

EXPECTED TO EXIST BY 1980

FOR CONTINUING PLANNING

LOCAL PROTECTION PROJECT

EXPECTED TO EXIST BY 1980
- ● STATE PLANNED
- — FEDERAL PLANNED

FOR CONTINUING PLANNING
- ● STATE
- — FEDERAL

NON-STRUCTURAL

FLOOD PLAIN INFORMATION STUDY

- ■ EXPECTED TO EXIST BY 1980
- ■ FOR CONTINUING PLANNING

FUTURE STUDY (ONLY EMPHASIS LIMIT SHOWN)

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION B

PLAN OF DEVELOPMENT

OFFICE OF APPALACHIAN STUDIES JULY 1969

II-4-111 FIGURE 4-9

5

PART II, CHAPTER 4
EXHIBIT 1
OF
REPORT FOR DEVELOPMENT OF
WATER RESOURCES
APPALACHIAN SUBREGION B

A V A C A T I O N S C A P E

F O R A P P A L A C H I A

A COMPREHENSIVE OUTDOOR RECREATION STUDY OF NORTH CENTRAL PENNSYLVANIA

Prepared by
Basin Planning Branch
Department of the Army
Baltimore District, Corps of Engineers

TABLE OF CONTENTS

		Page
	LIST OF FIGURES AND TABLES	ii
I.	INTRODUCTION	1
II.	OBJECTIVES AND CRITERIA	1
III.	THE STUDY AREA	3
	1. Topography and Climate	3
	2. Natural Resources and Land Use	5
	3. Existing Recreation	7
	4. Recreation Demands	10
	5. Meeting the Demands	17
IV.	A PLAN FOR DEVELOPMENT	17
	1. Land Classification	17
	2. Recreation Development Centers	18
	3. Access and Movement	25
	4. Scenic Rivers	25
	5. Wilderness Areas	26
	6. General Development	26
	7. Economic Impact	27
V.	SUMMARY	28
	1. General Conclusions	28
	2. Recommendations	28
	BIBLIOGRAPHY	30

LIST OF FIGURES AND TABLES

FIGURES		OPPOSITE PAGE
1.	Physiographic Provinces	4
2.	Transportation Facilities	6
3.	Existing Recreation Facilities	12
4.	Trends in Outdoor Recreation	13*
5.	Master Development Plan	20

TABLES		ON PAGE
I.	"Vacationscape" Area	4
II.	Ownership of Forest Lands	5
III.	Inventory of Existing Recreation Facilities .	11
IV.	Inventory of Proposed Recreation Facilities .	12
V.	Recreation - Demand, Supply, Needs Summary ..	15
VI.	Hunting and Fishing Demands	16
VII.	Recreation Development Centers	22-24
VIII.	Population Growth and Projections	27

* On page 13.

I. INTRODUCTION

This broad recreational study of a selected portion of north-central Pennsylvania is one of the many components of the Appalachian Water Resource Survey. It was assigned to the Baltimore District by the Office of Appalachian Studies, Corps of Engineers, Cincinnati, Ohio, on 6 February 1967. Due to limitations on time and funds, the study was restricted to a review of available information, derivation of a broad master plan, and the identification of water-associated facilities that appear to be desirable for recreational development in the area.

This report is the first phase of a complete study that is needed to define a comprehensive plan for the development of the recreation potential of north-central Pennsylvania. It represents the results of field trips, office visits, and meetings with various Federal, state, and local planning agencies conducted to formulate a broad master recreational plan for the area. The plan outlined, if implemented, would constitute a major step toward the conservation and enhancement of the region's recreational resources, in addition to meeting many of the recreational needs of the resident and visiting public, and stimulating the economy of this depressed area.

II. OBJECTIVES AND CRITERIA

The Appalachian Region, despite an abundance of generally underdeveloped natural resources and latent potential for economic growth, has not kept pace with the economic prosperity of the rest of the nation. Large portions of the region today lack an adequate economic base to support sustained growth. Further, there has been increased emphasis placed on preservation, enhancement, and development of the scenic and recreational resources of the nation. These two conditions, the need for regional economic development and the increased importance of outdoor recreational resources, form the background objectives for this study.

The objectives, in turn, guide the selection of the study area to north-central Pennsylvania, since this portion of Appalachia has extensive undeveloped outdoor recreational resources and the need for an improved economy. North-central Pennsylvania is one of the few large land areas in the northeastern United States which has remained sparsely populated and undeveloped while being almost completely surrounded by large, rapidly growing metropolitan areas. Similar to other portions of Appalachia, the rate of population growth and average family income lags behind the national averages. The mountains, streams, forests, and over-all scenic beauty provide excellent potential for creating a year-round recreation complex which could be the stimulus needed to improve the region's economy by creating new jobs and attracting people and recreation-oriented industries into the area.

CANADA
LAKE ONTARIO
NEW YORK
LAKE ERIE
ALBANY
RIVER
VERMONT
NEW HAMPSHIRE
MAINE
MASS.
BINGHAMTON
DELAWARE
HUDSON
CONN.
R. I.
SCRANTON
WILLIAMSPORT
PENNSYLVANIA
NEW YORK
NEW JERSEY
ATLANTIC OCEAN
PITTSBURGH
HARRISBURG
SUSQUEHANNA R.
RIVER
PHILADELPHIA
MARYLAND
BALTIMORE
CHESAPEAKE BAY
DELAWARE
W. VA.
VA.
VICINITY MAP
SCALE OF MILES
50 0 50 100

In the growing population centers surrounding the study area, scenic values and outdoor recreational resources are being lost to urban sprawl, highways, industry, environmental pollution of all types, and numerous land and water misuses. While this is also occurring to some extent within the study area, it is still very limited. Of primary importance now is the formulation of a broad plan which would include development of the recreational resources, while conserving and enhancing the scenic, historic, and cultural values.

As discussed in this study, "recreation" refers to non-urban outdoor activities with emphasis on meeting the needs of the overnight and vacationing visitor. Accordingly, emphasis has been placed on identification of areas which have a potential as recreational bases or centers, and recommendations for their development as all-season recreational complexes have been made. Included within several of these proposed complexes would be facilities which are existing or presently being planned by various agencies, as well as new facilities required to sustain year-round operation. As a part of these complexes, potential slack-water developments with water-associated recreation facilities are identified. These developments are essential enhancements in an area which has relatively few natural lakes or reservoirs. Not only would they impart an important scenic impact to the landscape, but they would also satisfy many of the water-based recreation needs of the visiting public.

The study also considers the transportation needs generated, particularly the needs for improvement of highway access routes to and within the area, and recreational travel by water and various types of trails. The latter considerations lead to the examination of the potential for establishment and management of "wild" or "scenic" rivers, wilderness areas, and other potential open-space recreation opportunities.

III. THE STUDY AREA

1. TOPOGRAPHY AND CLIMATE

Encompassing an area of approximately 9,500 square miles, this study includes all or portions of 13 north-central Pennsylvania counties within the following boundaries: the New York State line on the north; U.S. Route 219 south of Interstate Highway 80 on the west (excluding lands within the Allegheny National Forest boundary); Interstate 80 eastward to and along the southern borders of Clinton, Lycoming, Sullivan, Wyoming, and Susquehanna Counties on the south; and the eastern boundary of Susquehanna County on the east. A location map of the study area is shown on the opposite page, and Table I presents an areal breakdown of the "Vacationscape" counties.

Table I

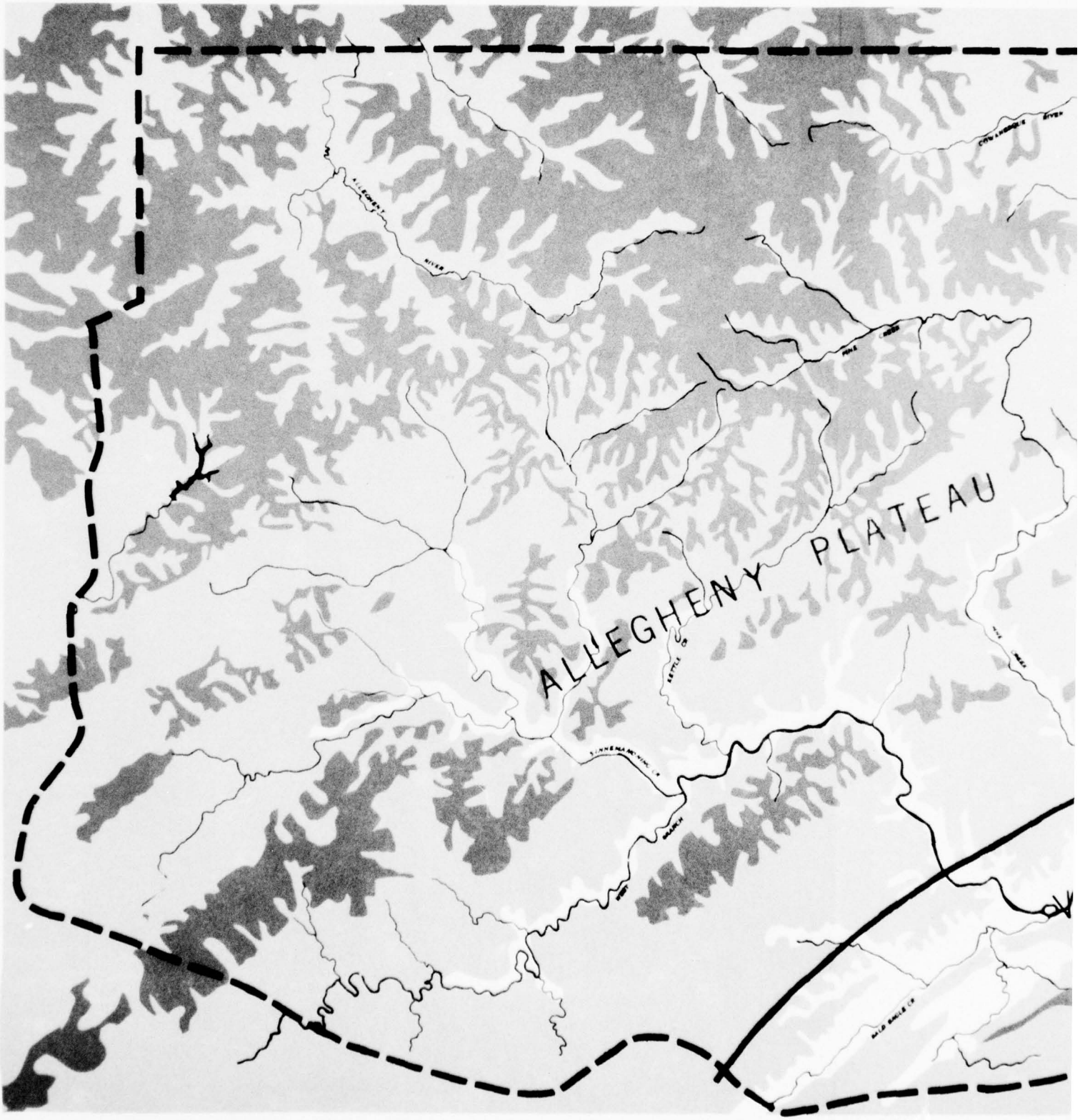
"VACATIONSCAPE" AREA

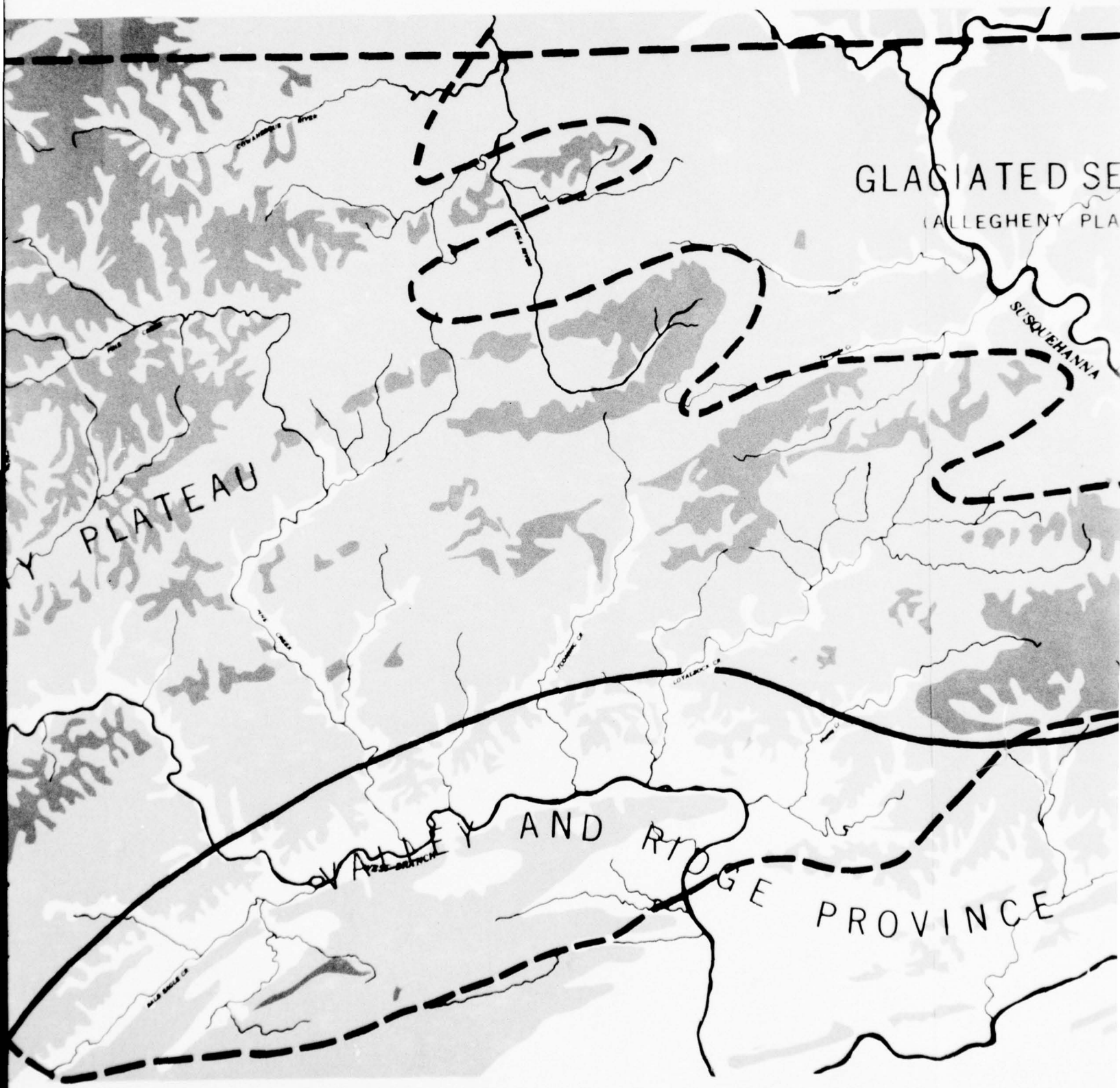
COUNTY	PERCENT WITHIN STUDY AREA	ACREAGE
Bradford	100	739,584
Cameron	100	256,896
Centre	25	182,272
Clearfield	39	289,792
Clinton	100	577,216
Elk	60	314,368
Lycoming	100	782,528
McKean	65	412,940
Potter	100	699,008
Sullivan	100	306,304
Susquehanna	100	537,984
Tioga	100	735,808
Wyoming	100	258,496
	TOTAL ACREAGE	6,093,196

Comprising portions of two physiographic provinces, as shown on Figure 1, the study area has a variety of topography, vegetation, and land uses. Rugged mountain and plateau lands west and north of the Allegheny Front present the most formidable features in te area. This is the Allegheny Plateau Province, where the landscape varies from heavily wooded, rolling plateaus to deep, narrow gorges cut by free-running streams. Elevations vary from 550 to 2,600 feet above mean sea level. The headwaters of the Allegheny and Genesee Rivers, and 15 major tributaries of the West Branch and the upper Susquehanna Rivers rise in these highlands. Due to limited access, a major portion of this area remains wild and primitive in character.

The northeastern portion of the Allegheny Plateau Province is characterized by a gently rolling landscape, having been smoothed by glaciation in the past. Agricultural lands predominate on the flood plains, with woodlands covering the stream banks and uplands. Spectacular views of the Susquehanna as it meanders through the pastures and croplands of the broad valleys can be attained from high points along several of the major highways. Fishing and boating on the Susquehanna and its tributaries are important recreational activities.

The northern part of the Appalachian Valley and Ridge Province, south of the Allegheny Front, falls within the study area. Here, the valleys are broader, but mainly rural in character with urban centers located along the major rivers and streams. The mountains are narrow with parallel forested ridges trending in a northeast-southwest direction.


ALLEGHENY PLATEAU


GLACIATED SE
(ALLEGHENY PLA
SUSQUEHANNA
Y PLATEAU
Y AND RIDGE PROVINCE

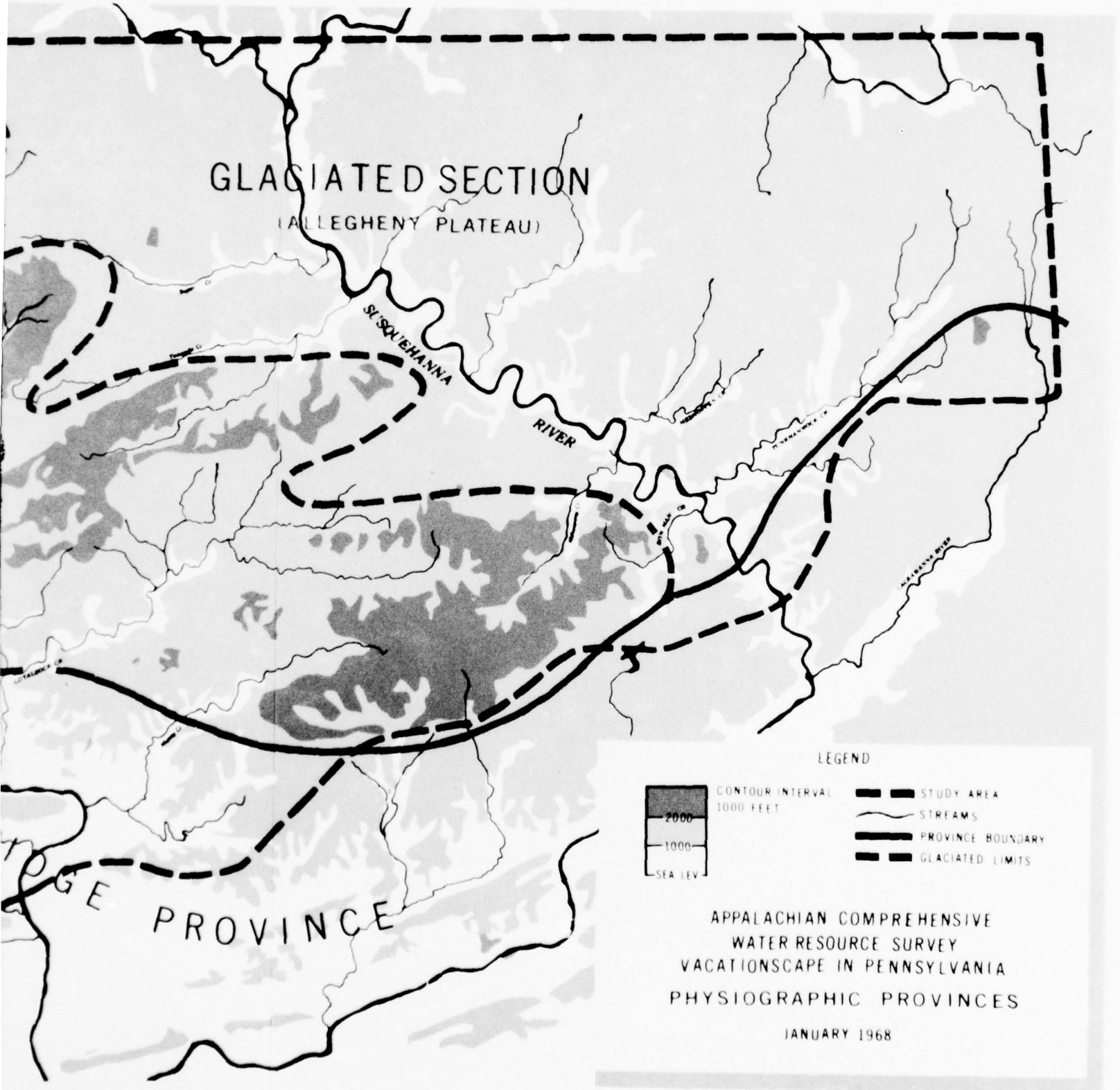

GLACIATED SECTION
(ALLEGHENY PLATEAU)
SUSQUEHANNA
RIVER
GE PROVINCE
LEGEND
CONTOUR INTERVAL
1000 FEET
2000
1000
SEA LEV
STUDY AREA
STREAMS
PROVINCE BOUNDARY
GLACIATED LIMITS
APPALACHIAN COMPREHENSIVE
WATER RESOURCE SURVEY
VACATIONSCAPE IN PENNSYLVANIA
PHYSIOGRAPHIC PROVINCES
JANUARY 1968

FIGURE 1

The West Branch Susquehanna River flows through this area transecting the ridges, joining the main stem of the Susquehanna at Northumberland, Pennsylvania, several miles south of the study area boundary.

The climate throughout this region is variable. Average winter temperatures are in the low 20's and summertime averages are in the 70's. Average annual precipitation is about 40 inches with an average annual snowfall of 42 inches. This climate is very conducive to a variety of outdoor recreational activities throughout the year. Winter temperatures and snowfall at the higher elevations allow for skiing and other winter sports, while the summer climate is ideal for camping, hiking, swimming, boating, and related outdoor recreation pursuits.

2. NATURAL RESOURCES AND LAND USE

Forestry - Dominating the study area are 4-1/2 million acres of forested lands, which comprise more than three-fourths of the total area. These once-virgin forests, attracting some of the first settlers to the area, were the site of a major lumbering industry by 1840. Lumbering flourished until the early 1900's when the accessible supply of merchantable timber was depleted. In the glaciated part of the Allegheny Plateau Province, most of the land was cleared for farming. In the unglaciated Allegheny Plateau Province, and to a lesser degree in the Valley and Ridge Province, the land is too steep for farming and remains largely forested. These forests are predominantly hardwoods of oak, hickory, sugar maple, beech, and birch, with some white pine scattered throughout. At the present time, approximately 100 million board feet of lumber and 110,000 cords of pulpwood are being harvested annually. Through management and natural recovery of the forests, production can be expected to increase substantially.

Table II

OWNERSHIP OF FOREST LANDS

State	26%
Other Public (Game Lands)	8%
Farmer Owned	15%
Forest Industry Owned	7%
Other Private	44%
TOTAL	100%

Some of the private forest lands are held for mineral interests, and a large number of acres are held by private owners for hunting and general recreational use. Table II, above, shows the percent of ownership of forest lands in the study area. Other forest purposes include watershed protection for the headwaters of the Allegheny and Genesee Rivers, and tributaries of the Susquehanna River.

Agriculture - Although the total value of marketed farm products is increasing throughout north-central Pennsylvania, the total acreage in crop production and the number of productive farms continue to decline. Total land acreage in pasture and cropland varies from a high of 32 percent in the eastern portion to a low of 7 percent in the western portion. The trend in reduction of farm acreage is providing more open space lands, some of which are being managed for new forests, game habitat, and recreational use.

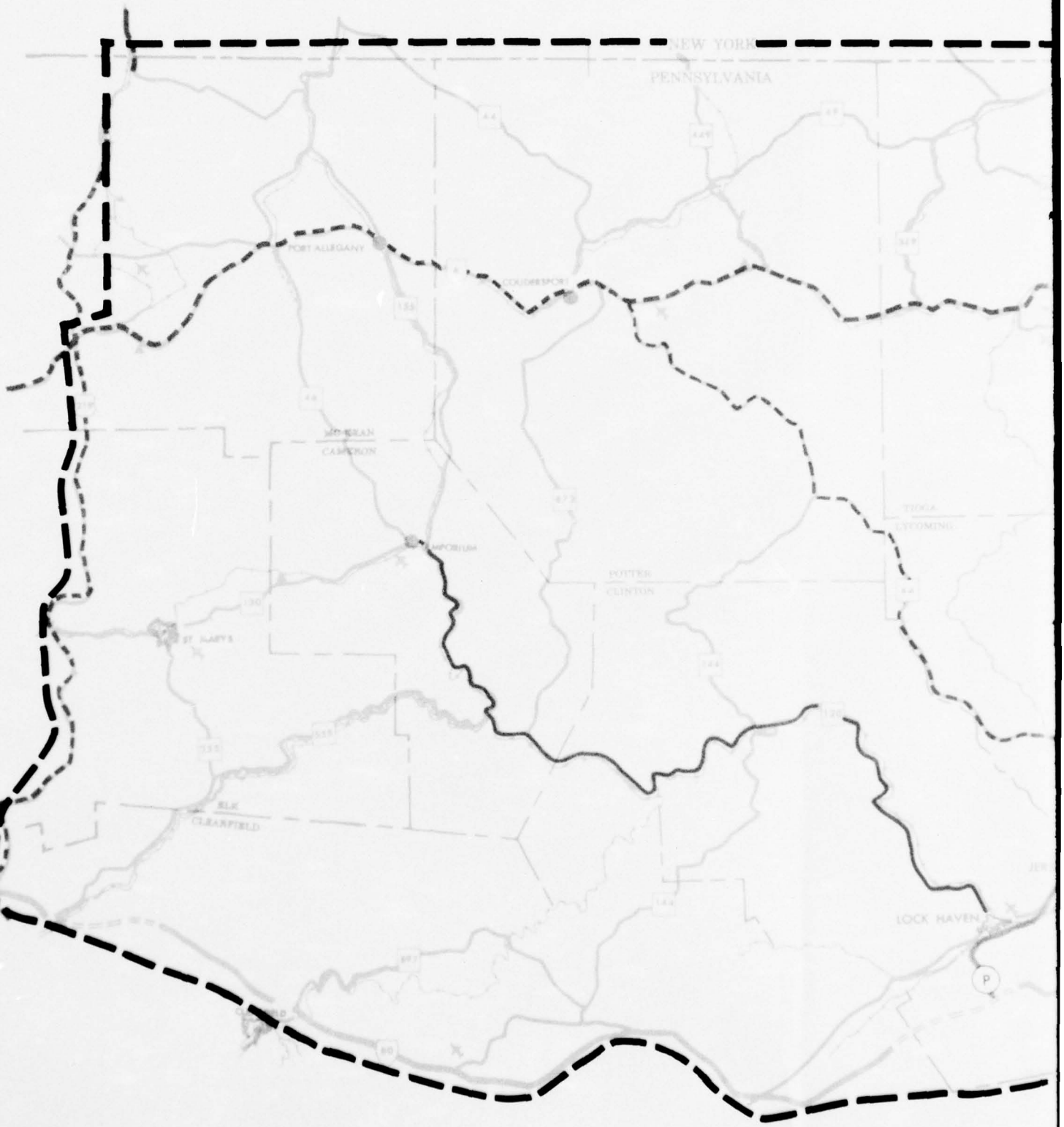
Industry - Industry is presently expanding, especially in the southern portion along the West Branch Susquehanna River. Industry has not located in the upper plateau region due to its inaccessibility. Both urban and industrial expansion are presently competing for agricultural lands, particularly in the Valley and Ridge Province.

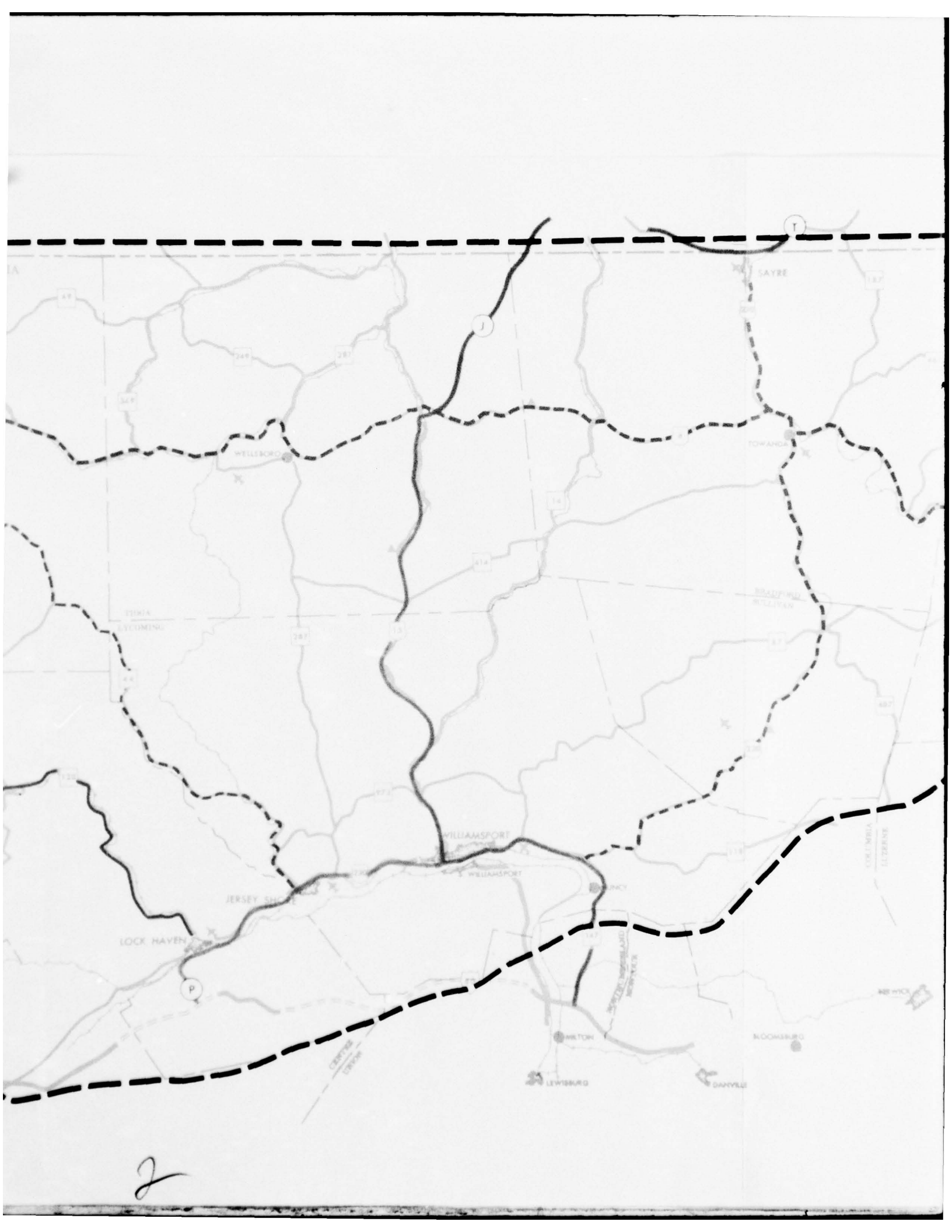
The early lumber and mining industries have declined, but evidence of land exploitation remains in the form of mine drainage pollution, slag piles, denuded strip-mined lands, and eroded hillsides. Along the West Branch Susquehanna River, industries such as apparel, textiles, leather products, and food processing have developed.

Transportation - A major problem in the development of north-central Pennsylvania is that public access is inadequate. The topography and remoteness of the area have restricted highway development mainly to narrow, low-volume routes. The Commonwealth of Pennsylvania and the Federal Government have recognized this deficiency and presently have programs underway to improve highway access. Interstate Highways, Appalachian Corridors, and access roads, in addition to state and county routes, are being planned, constructed, and improved. Presently planned highways will speed traffic to the area, but access to major portions will remain inadequate. To assure economic success of recreational developments, roads designed with the tourist and recreationist in mind are needed. Several existing routes have the potential for improvement, enhancement, and classification as scenic tourways. Highway improvement over existing rights-of-way will reduce further impairment of scenic values of the area.

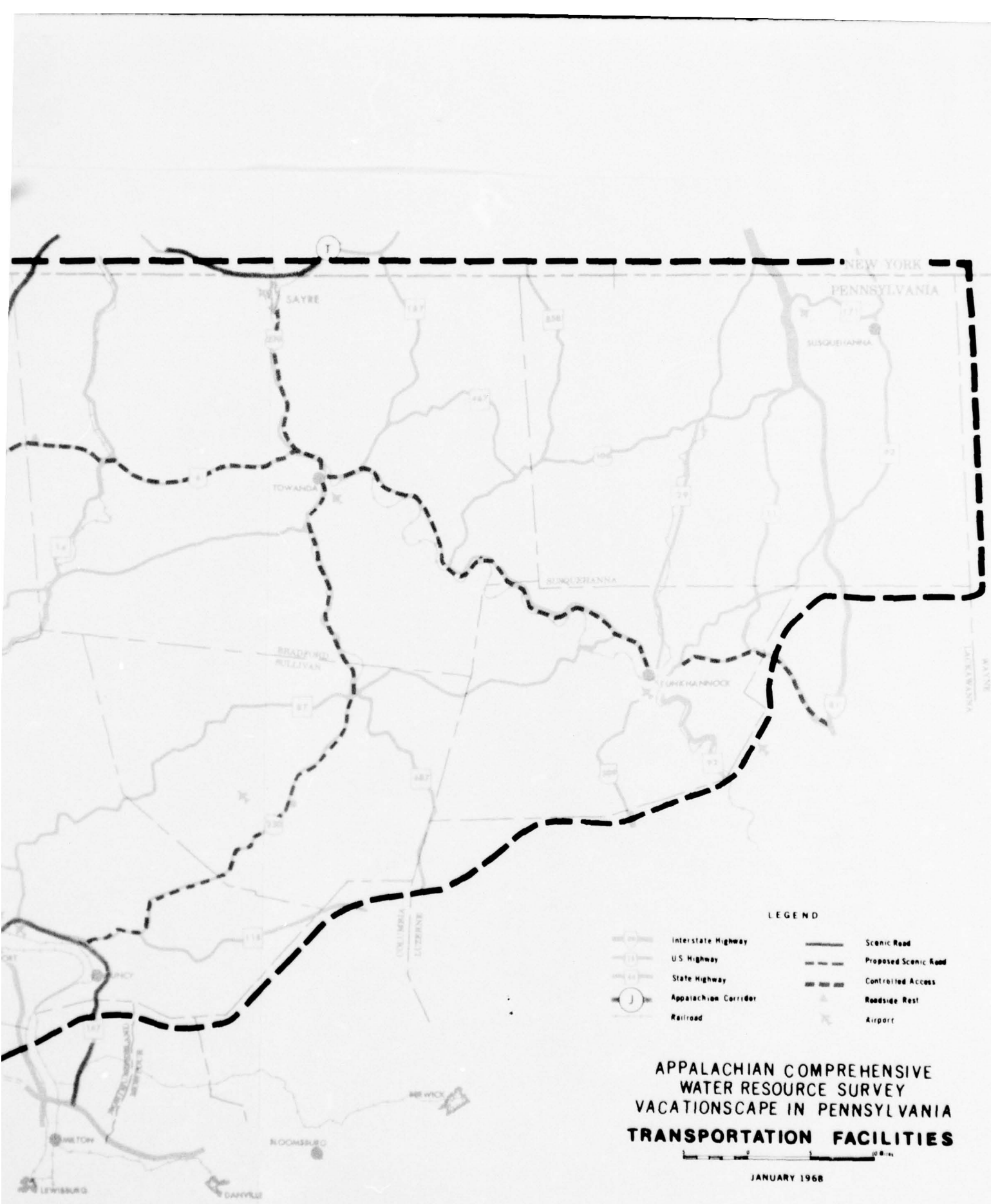
Although several railroad systems exist throughout the area, present use is almost entirely for the movement of freight. There is a potential for future improved passenger service including scenic railway rides along existing routes, and service between major metropolitan areas and recreation centers. This type of service will become increasingly important and necessary in the future if large urban populations are to be encouraged to use the more remote recreation centers.

Sixteen airports and landing fields exist within the study area, and most have some potential for development to interest the recreationist. A system of small airports could provide year-round service to and between recreation centers, as well as scenic sky rides. Figure 2 indicates the locations of urban areas and existing and planned major transportation facilities.


NEW YORK
PENNSYLVANIA
PORT ALLEGANY
COUDERSPORT
CAMERON
ELK
CLEARFIELD
POTTER
CLINTON
TIOGA
LYCOMING
LOCK HAVEN


SAYRE
WELLSBORO
TOWANDA
TIOGA
LYCOMING
WILLIAMSPORT
JERSEY SHORE
LOCK HAVEN
MILTON
LEWISBURG
DANVILLE
BLOOMSBURG

2



APPALACHIAN COMPREHENSIVE
WATER RESOURCE SURVEY
VACATIONSCAPE IN PENNSYLVANIA

TRANSPORTATION FACILITIES

JANUARY 1968

FIGURE 2

Waterways - The headwaters of three river systems, the Allegheny, the Genesee, and the Susquehanna rise in these highlands. For the most part, these rivers provide good quality water for municipal, industrial, and recreational uses. However, mine drainage pollution, particularly on the west Branch Susquehanna River and some of its tributaries, seriously affects recreational use of these waters. In addition, municipal and industrial pollution restricts recreation activities in a few locations. Future expansion of water-associated recreation along these streams will depend upon the quality and extent of stream-side recreational development provided, and the success of pollution abatment programs. Development of impoundments for slack-water recreation and to supplement natural streamflow for downstream recreation will be a necessity.

3. EXISTING RECREATION

Visitation to various types of public recreation areas in north-central Pennsylvania for 1963 amounted to approximately 3.5 million recreation-days. The most intensively developed and visited sites are the 20 state parks located throughout the area. Nearly all are located adjacent to natural lakes, reservoirs, or streams. Parks such as Worlds End, Hills Creek, and Leonard Harrison attest to the variety and quality of scenic beauty which can be enjoyed in this region. Camping facilities are presently developed at 11 of these parks and at several private campgrounds. Six of these private campgrounds, operating under the auspices of the Campground Association of Pennsylvania, provide 290 camp units within the study area.

Major winter sports sites are limited to four locations with facilities for day-time skiing. Denton Hill State Park in Potter County is the only state operated ski development. Other winter activities such as skating, sledding, and snow play, are engaged in at innumerable undeveloped locations.

Boat marinas and access points can be found along the West Branch and the upper Susquehanna Rivers, and at several lakes and reservoirs. Boating activities include pleasure cruising, water skiing, fishing, float trips, and white-water canoeing. Lack of large bodies of water practically eliminates activities such as sailing and large pleasure-craft boating.

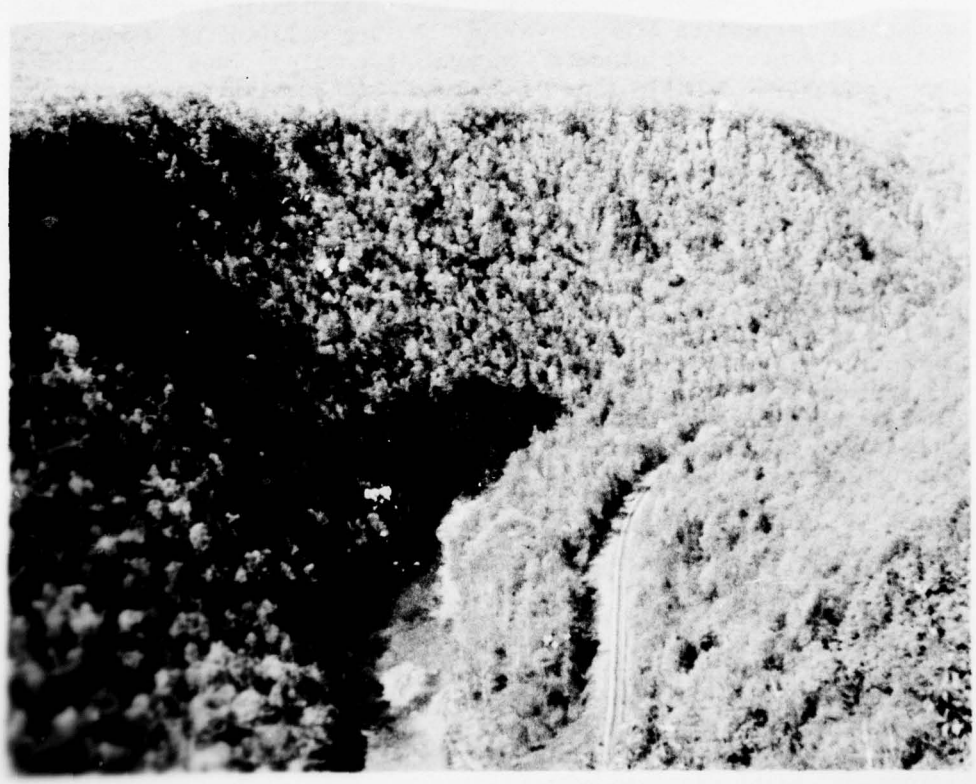
Fish and wildlife are major attractions of the area. Deer, bear, turkey, ruffed grouse, and squirrels are plentiful and provide thousands of days of hunting. Approximately two million recreation-days of hunting and fishing took place within this region in 1964.

Left / Sinnemahoning State Park, at Geo. B. Stevenson Reservoir.

Center / Sinnemahoning Creek flowing through Cameron County.

Below left / A potential recreational site in Tioga County near Wellsboro, Pennsylvania.

Below / A view from the Harrison State Park overlooking the Pennsylvania Grand Canyon.



Other areas offering recreation opportunities include state forests and picnic areas, state game lands, farm game cooperatives, Federal reservoirs, private fee-fishing lakes and shooting preserves, resorts, and golf courses. Other sites of interest to the visitor include historical markers and monuments, vista points, and covered bridges. Activities such as hiking, horseback riding, sightseeing, and nature study are engaged in along the roads and trails throughout the area.

An inventory of existing and proposed recreation sites is presented in Tables III and IV. A map of existing recreation facilities is shown on Figure 3.

4. RECREATION DEMANDS

North-central Pennsylvania is strategically located as a potential recreation area capable of serving millions of persons. Within five hours' transportation time (200 miles), and encircling the study area, are 48 Standard Metropolitan Statistical Areas with a 1960 population of 40 million persons. This population increased by 16 percent between 1950 and 1960 and is expected to increase at an accelerated rate in the present decade.

Many factors will create an increase in the demand for recreation. The proportion of persons living in metropolitan areas in the northeast where recreation space is presently limited is expected to increase from 79 percent in 1960 to nearly 85 percent by the year 2000. The proportion of persons in the 15 to 24 age category, the most active recreationists, should increase from 13 percent in 1960 to 17 percent by the year 1976. The average 39-hour work week of 1960 should decrease to 36 hours by 1976, and possibly to 32 hours by the year 2000, according to U.S. Bureau of the Census projections.

Family incomes are expected to increase considerably in the future. As indicated in the "Outdoor Recreation Resources Review Commission Report" (ORRRC), participation rates increase as income increases, with a maximum rate reached in the $7,500 to $10,000 income bracket. The percent of families with incomes of $10,000 and over is expected to increase from 14 percent (1960) to 40 percent by 1976, and to 60 percent by the year 2000. This change will create new demands for participation in the more costly sports such as skiing, boating, and horseback riding. Median family income of the 48 Standard Metropolitan Statistical Areas within a five-hour drive of the study area was $6,226 in 1960, as compared to a study area average of $5,029.

Table III

INVENTORY OF EXISTING RECREATION FACILITIES

EXISTING AREA	JURISDICTION: FEDERAL	JURISDICTION: STATE	JURISDICTION: LOCAL OR PRIVATE	LOCATION (COUNTY)	ACREAGE: TOTAL	ACREAGE: WATER	VISITATION (1963) *1966	MAJOR ACTIVITIES: SWIMMING	BOATING	FISHING	HUNTING	PICNICKING	TENT CAMPING	TRAILER CAMPING	GROUP CAMPING	SKATING	SKIING	HIKING	HISTORICAL
GAME LANDS (10 UNITS)		X		BRADFORD	48,026	69	25,100			X	X							X	
LAMBS HILL PICNIC AREA		X		"	4	-						X							
SAYRE ACCESS AREA		X		"	16	RIVER	17,500		X	X									
11 BOAT ACCESS AREAS		X	X	"		"			X	X									
GAME LAND NO. 14		X		CAMERON	13,679	-	7,500			X	X							X	
SINNEMAHONING PARK		X		"	160	142	253,294*	X	X	X		X	X					X	
WAYSIDE MEMORIAL PICNIC		X		"	2	-	23,129*					X							
GAME LAND NO. 92 + 100		X		CENTRE	16,758	-	5,850			X	X								
PARKER DAM PARK		X		CLEARFIELD	525	20	126,105*	X	X	X	X	X	X					X	
S. B. ELLIOTT PARK		X		"	721	-	43,385*				X	X	X					X	
GAME LANDS (5 UNITS)		X		"	22,425	-	9,125			X	X							X	
BUCKTAIL PARK		X		CLINTON	23,013	RIVER	-			X	X							X	
GAME LAND NO. 89		X		"	10,571	-	550			X	X							X	
HYNER RUN PARK		X		"	17	3	66,864*	X			X		X						
KETTLE CREEK PARK		X		"	1,160	160	167,428*	X		X	X	X	X	X	X			X	
LAMAR FISH HATCHERY	X			"	196	3	6,000			X		X				X			
RAVENSBURG PARK		X		"	423	3	48,090*			X	X	X						X	
SPROUL FOREST		X		"	236,975	-	175,000			X	X							X	
JESSE HALL PICNIC		X		"	6	-	3,984*					X							
HYNER VIEW PICNIC		X		"	6	-	27,990*					X							
LOCK HAVEN BOAT ACCESS			X	"	-	RIVER	-		X										
BENEZETTE PARK		X		ELK	124	1	77,415*	X		X		X							
ELK PARK		X		"	12	2	25,625*		X	X		X							
EAST BR. CLARION RIVER RES.	X			"	2,100	1,160	106,400		X	X		X							
ELK FOREST		X		"	184,597	-	112,500			X	X							X	
GAME LAND NO. 25		X		"	23,136	-	4,000			X	X								
GAME LANDS (6 UNITS)		X		LYCOMING	39,435	-	17,100			X	X							X	
LITTLE PINE PARK		X		"	500	90	211,261*	X	X	X		X	X	X					
LOYALSOCK GAME FARM		X		"	399	-	10,000			X									
SUSQUEHANNA PARK		X		"	25	-	197,885*	X	X	X		X						X	
TIADAGHTON FOREST		X		"	182,818	-	115,500			X	X							X	
UPPER PINE BOTTOM PICNIC		X		"	4	-	23,220*					X							
WILD TURKEY FARM		X		"	1,552	-	2,000			X									
HIGHLAND SKI AREA			X	"	-	-	-									X			
5 BOAT ACCESS AREAS			X	"	-	RIVER	-		X	X									
GAME LANDS (3 UNITS)		X		McKEAN	20,235	-	6,600			X	V							V	
CHERRY SPRINGS PICNIC		X		POTTER	48	-	54,240*					X	X						
DENTON HILL PARK		X		"	500	-	45,889*					X				X			
GAME LANDS (3 UNITS)		X		"	17,905	-	8,000			X	X							X	
LYMAN RUN PARK		X		"	800	40	46,328*	X	X	X	X	X	X	X					
OLE BULL PARK		X		"	67	1	124,190*	X		X		X	X	X				X	
PATTERSON PICNIC		X		"	10	-	4,198*					X							
PROUTY PLACE PICNIC		X		"	5	-	1,484*					X							
STERNVILLE PARK		X		"	1,390	POOL	121,372*	X		X	X	X	X	X				X	
SUSQUEHANNOCK FOREST		X		"	293,670	-	114,500			X	X		X					X	
LUMBER MUSEUM		X		"	-	-	-												
DRY RUN PICNIC		X		SULLIVAN	7	-	3,058*				X		X						
HAPPY HILL SKI AREA			X	"	-	-	-									X			
HIGH CROSS MONUMENT		X		"	22	-	33,448*				X								
HUNTERS LAKE AREA		X		"	2,473	127	6,550		X	X	X				X				
GAME LAND NOS. 13 + 66		X		"	43,196	110	15,000			X	X							V	
WORLDS END PARK		X		"	1,891	STREAM	201,953*	X		X	X	X	X	X				X	
WYOMING FOREST		X		"	37,188	40	22,600			X	X							Y	
ELK MOUNTAIN SKI			X	SUSQUEHANNA	-	-	-									X			
GAME LANDS (5 UNITS)		X		"	11,525	80	11,000			X	X							X	
STILLWATER RES.	X			"	596	83	-			X	X								
STUMP POND AREA		X		"	22	22	1,000		X	X						X			
3 BOAT ACCESS AREAS		X	X	"	-	RIVER, LAKE	-		X	X									
ASAPH RUN PICNIC		X		TIOGA	1	STREAM	24,421*			X		X							
BRADLEY WALES PICNIC		X		"	4	-	10,009*					X							
COLTON POINT PARK		X		"	540	-	98,658*			X	X	X	X	X	X			X	
COUNTY BRIDGE PICNIC		X		"	4	STREAM	11,211*			X		X							
FALL BROOK PICNIC		X		"	4	STREAM	6,619*					X							
HAMEY STOCK PICNIC		X		"	1	-	5,140*					X							
HILLS CREEK PARK		X		"	196	133	102,269*	X	X	X		X	X	X				X	
LEONARD HARRISON PARK		X		"	961	-	281,382*			X	X	X	X	X				X	
MORRIS PICNIC		X		"	150	-	6,352*					X							
STONY FORK PICNIC		X		"	4	-	5,119*			X		X							
TIADAGHTON PICNIC		X		"	1	-	3,556*					X							
TIOGA FOREST		X		"	152,239	-	111,100*			X	X							X	
GAME LANDS 90S, 31 + 70R		X		"	22,016	-	4,470			X	X							X	
REEDWOOD LAKE		X		"	-	80	-		X	X									
GAME LANDS 50, 52		X		WYOMING	33,238	26	10,000			X	X								
STEVENS LAKE AREA		X		"	93	60	3,429			X						X			
9 BOAT ACCESS AREAS		X	X	"	-	RIVER, LAKE				X									

TABLE III (CONTD.)
INVENTORY OF EXISTING RECREATION FACILITIES

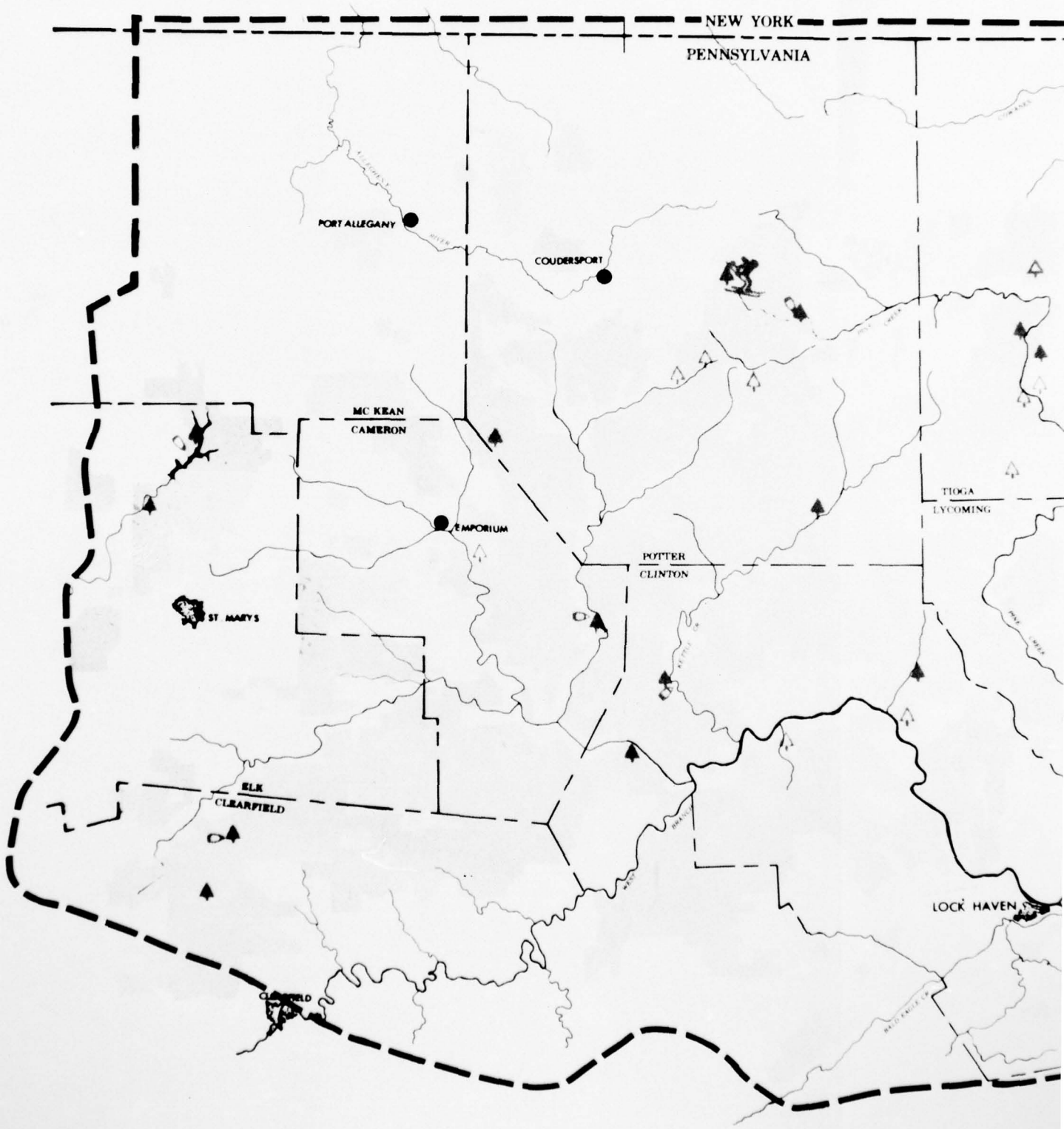
EXISTING AREA	JURISDICTION: FEDERAL	JURISDICTION: STATE	JURISDICTION: LOCAL OR PRIVATE	LOCATION (COUNTY)	ACREAGE: TOTAL	ACREAGE: WATER	VISITATION	MAJOR ACTIVITIES: SWIMMING	BOATING	FISHING	HUNTING	PICNICKING	TENT CAMPING	TRAILOR CAMPING	GROUP CAMPING	SKATING	SKIING	HIKING	HISTORICAL
BLACK MOSHANNON*				CENTRE		250		X	X	X		X	X				X		
POE VALLEY*				MIFFLIN				X	X	X		X	X						
POE PADDY*				MIFFLIN						X		X	X						
HARRY JOHNS*				CENTRE								X							
McCALL DAM*				CENTRE						X		X							
LOLETA*				ELK				X		X		X	X						
TWIN LAKES*				ELK				X		X		X	X						
KIASUTHA*				McKEAN				X	X	X		X	X						
KENNEDY SPRING*				McKEAN								X							

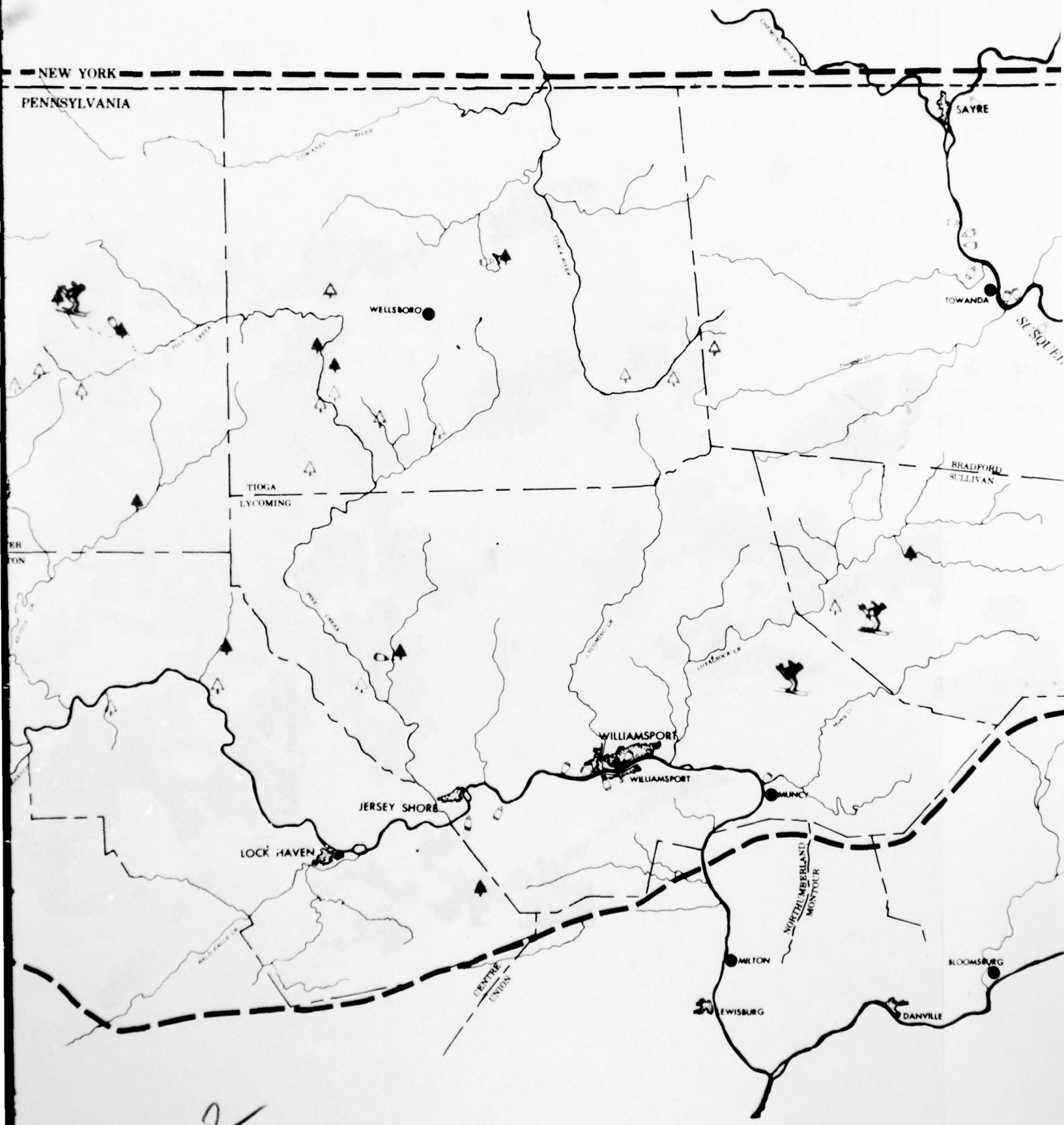
* These facilities added to table by request of Commonwealth of Pennsylvania in letter dated 2 September 1969 and from data shown on map published by the Commonwealth.

Table IV

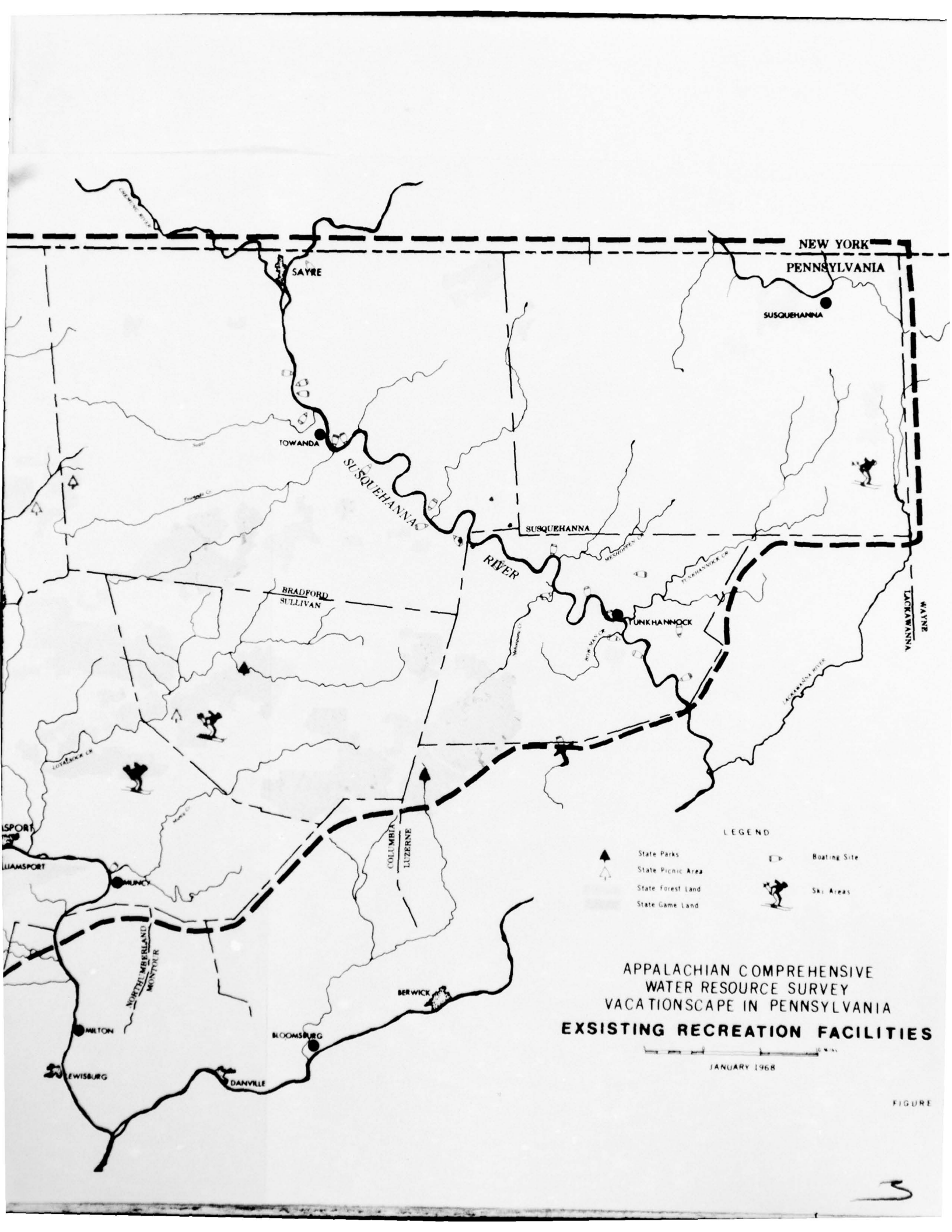
INVENTORY OF PROPOSED RECREATION FACILITIES

PROPOSED/PLANNED OR UNDER CONSTRUCTION	JURISDICTION: FEDERAL	JURISDICTION: STATE	JURISDICTION: LOCAL OR PRIVATE	LOCATION (COUNTY)	ACREAGE: TOTAL	ACREAGE: WATER	VISITATION (1963) *1966	MAJOR ACTIVITIES: SWIMMING	BOATING	FISHING	HUNTING	PICNICKING	TENT CAMPING	TRAILER CAMPING	GROUP CAMPING	SKATING	SKIING	HIKING	HISTORICAL
MILL CREEK PARK		X		BRADFORD	750	100	-	X	X	X		X	X	X	X			X	
FRENCH AZILUM HISTORICAL		X		"	250	-	-												X
QUEHANNA AREA		X		CAMERON	-	-	-				X		X	X	X			X	
BLANCHARD RESERVOIR	X	X		CENTRE	1,900	1,730	-	X	X	X		X	X	X				X	
EAGLE IRON WORKS & CURTIN VILLAGE HISTORICAL		X		"	-	-	-												X
OTOCSIN RECREATION AREA		X		CLEARFIELD	47,743	1,432	-	X	X	X		X	X	X	X	X	X	X	X
OSWAYO SPRINGS		X		POTTER	250	-	-		X	X									
DRINKER & DUNDAFF CREEKS		X		SUSQUEHANNA	-	-	-		X	X									
SPRINGVILLE PARK		X		"	1,500	516	-	X	X	X		X	X	X	X			X	
MILL VILLAGE HISTORICAL		X		"	-	-	-												X
COWANESQUE RESERVOIR	X			TIOGA	-	160	-	X	X			X	X	X				X	
MILL CREEK		X		"	-	82	-		X	X									
TIOGA-HAMMOND RESERVOIR	X			"	7,217	1,200	-	X	X	X		X	X	X				X	


NEW YORK
PENNSYLVANIA
PORT ALLEGANY
COUDERSPORT
MC KEAN
CAMERON
EMPORIUM
ST MARYS
POTTER
CLINTON
TIOGA
LYCOMING
ELK
CLEARFIELD
LOCK HAVEN


NEW YORK
PENNSYLVANIA
SAYRE
TOWANDA
WELLSBORO
TIOGA
LYCOMING
BRADFORD
SULLIVAN
WILLIAMSPORT
S WILLIAMSPORT
MUNCY
JERSEY SHORE
LOCK HAVEN
NORTHUMBERLAND
MONTOUR
MILTON
BLOOMSBURG
CENTRE
UNION
LEWISBURG
DANVILLE

2



APPALACHIAN COMPREHENSIVE
WATER RESOURCE SURVEY
VACATIONSCAPE IN PENNSYLVANIA

EXSISTING RECREATION FACILITIES

JANUARY 1968

FIGURE

Projected participation trends to the year 2000 are shown in Figure 4. Plotted from information contained in "Outdoor Recreation Trends", by the Bureau of Outdoor Recreation (April 1967), present trends indicated by the solid line far exceed the predictions made by ORRRC in 1960 (dashed line).

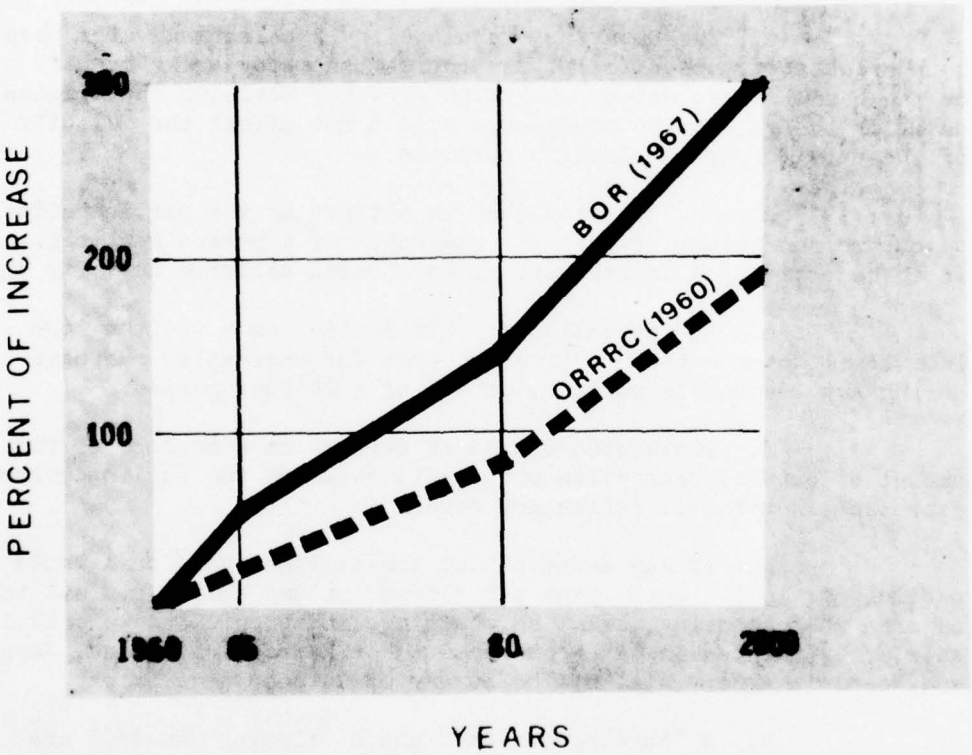


FIGURE 4 TRENDS IN OUTDOOR RECREATION
FOR SUMMERTIME ACTIVITIES

Demand, supply, and needs data for boating, swimming, camping, and picnicking are shown in Table V, and hunting and fishing demand data are shown in Table VI.

These data were prepared from information compiled by the Bureau of Outdoor Recreation and the Bureau of Sport Fisheries and Wildlife for the Office of Appalachian Studies. Planning assumptions, methodology, and definitions are as follows:

a. Per capita participation rates are the same as those found in ORRRC Report 19.

b. Ninety percent of the demand for outdoor recreation originates within 125 miles of the Appalachian Region boundary. The percentages do vary however, depending upon access routes, availability, and length of recreation visit.

c. The data were tabulated by Appalachian water area boundaries and revised to fit the recreation study area boundary on the basis of projected population growth. Revising the original data for the recreation study area should not affect the validity of the data for broad planning purposes.

d. An "activity day" is defined as the participation by one person in one activity in one day. If a person participates in three activities in one day, it is counted as three activity days.

e. A "recreation day" is defined as a visit by one individual to an outdoor recreation area for recreation purposes during any reasonable portion, or all of a 24-hour period.

f. Recreation demand is defined as a measure of the amount of outdoor recreation opportunities which the public desires, expressed in terms of recreation days.

g. It was assumed that the average individual would participate in 1.5 activities per recreation day during a visit to an area where boating, swimming, camping, and picnicking were available, as suggested in "A Report on Outdoor Recreation Demand, Supply, and Needs in Appalachia" by the Bureau of Outdoor Recreation.

h. A "hunting man-day" and a "fishing man-day" are defined as participation in hunting or fishing by one person during any reasonable portion of one day.

Table V

RECREATION DEMAND, SUPPLY, NEEDS SUMMARY
'VACATIONSCAPE' AREA

ANNUAL ACTIVITY DAYS - 1980

ACTIVITY	DEMAND	SUPPLY	NEEDS
Boating	1,262,500	1,105,800	156,700
Swimming	6,878,180	1,892,250	4,985,930
Camping	297,180	1,282,125	-
Picnicking	2,921,510	3,097,800	-
Total Activity Days	11,359,370	7,377,975	3,981,395
Total Recreation Days	7,572,913	4,918,650	2,654,263

ANNUAL ACTIVITY DAYS - 2000

ACTIVITY	DEMAND	SUPPLY	NEEDS
Boating	2,901,120	1,105,800	1,795,320
Swimming	15,870,580	1,892,250	13,978,330
Camping	682,570	1,282,125	-
Picnicking	6,612,100	3,097,800	3,514,300
Total Activity Days	26,066,370	7,377,975	18,688,395
Total Recreation Days	17,377,580	4,918,650	12,458,930

ANNUAL ACTIVITY DAYS - 2020

ACTIVITY	DEMAND	SUPPLY	NEEDS
Boating	7,178,320	1,105,800	6,072,520
Swimming	39,264,780	1,892,250	37,372,530
Camping	1,688,770	1,282,125	406,645
Picnicking	16,606,850	3,097,800	13,509,050
Total Activity Days	64,738,720	7,377,975	57,360,745
Total Recreation Days	43,159,146	4,918,650	38,240,496

Source: Supply of Outdoor Recreation Resources of Appalachia. USDI-BOR. December 1966.

Table VI

HUNTING AND FISHING DEMANDS
'VACATIONSCAPE' AREA

ESTIMATED HUNTING MAN-DAY DEMAND

COUNTY	1964	1980	2000	2020
		(In Thousands)		
McKean	88.4	111.6	150.3	191.6
Elk	59.3	74.8	100.8	128.5
Potter	67.1	84.7	114.0	145.4
Cameron	27.4	34.6	46.6	59.4
Tioga	120.3	124.0	133.4	153.4
Clinton	102.3	126.9	168.2	224.5
Clearfield	76.2	96.3	129.6	165.2
Lycoming	232.1	288.1	381.6	509.5
Bradford	138.4	142.6	153.4	176.4
Sullivan	31.2	32.1	34.5	39.7
Susquehanna	74.7	77.0	82.8	95.2
Centre	45.6	56.7	75.0	100.2
Wyoming	43.7	45.1	48.5	55.8
Totals	1,106.6	1,294.5	1,618.7	2,044.7

ESTIMATED FISHING MAN-DAY DEMAND

COUNTY	1964	1980	2000	2020
		(In Thousands)		
McKean	72.0	93.7	114.7	132.7
Elk	56.5	73.6	90.0	104.2
Potter	60.7	79.0	96.7	111.8
Cameron	38.1	49.5	60.6	70.1
Tioga	102.8	130.7	152.0	182.1
Clinton	117.1	153.4	188.3	225.4
Clearfield	66.0	85.8	105.1	121.6
Lycoming	248.1	325.0	398.8	477.4
Bradford	142.0	180.6	210.1	251.7
Sullivan	23.8	30.2	35.1	42.1
Susquehanna	112.8	143.5	166.9	199.9
Centre	39.6	51.8	63.6	76.1
Wyoming	55.9	71.1	82.7	99.0
Totals	1,135.2	1,467.9	1,764.5	2,094.0

Source: BSF&W. Cincinnati, Ohio. October 67.

5. MEETING THE DEMANDS

A variety of programs are currently underway that contribute toward meeting demands of additional outdoor recreational opportunity. The Pennsylvania State Planning Board is preparing a state-wide park plan to guide these programs. Under "Project 70", open space lands are being acquired for recreational use. A $500 million bond issue for land and water conservation and reclamation was approved by Pennsylvania's voters in May of 1967. Two hundred million dollars of this bond issue are designated for construction and development of state and local recreation areas. The Tourist Promotion Law of 1961 provides matching funds to Pennsylvania counties for promotion of recreation and tourist attractions. Several of the counties in the study area, recognizing that recreation is an important part of their economy, are actively engaged in recreation planning.

One of several methods used to encourage recreational use of private lands is leasing under the Cooperative Farm Game Project, which has opened approximately 160,000 acres to public hunting. Upstream watershed projects providing new recreation sites are continually being developed by the Soil Conservation Service under Public Law 566, the Watershed Protection and Flood Prevention Act, as amended. The Susquehanna River Basin Study, presently under way, will indicate new recreational opportunities for potential development. State and Federal beautification programs include the abatement of mine drainage and stream pollution, and the landscaping of strip-mined lands and highways.

IV. A PLAN FOR DEVELOPMENT

1. LAND CLASSIFICATION

The 1962 Outdoor Recreation Resources Review Commission recommended that "The following system of classifying recreation resources should be adopted and applied to aid in the management of recreation resources, to enhance the quality of recreation opportunities, and to facilitate the orderly development of recreation resources."* The classification recommended is below.

Class I	-	High-Density Recreation Areas
Class II	-	General Outdoor Recreation Areas
Class III	-	Natural Environment Areas
Class IV	-	Unique Natural Areas
Class V	-	Primitive Areas
Class VI	-	Historic and Cultural Sites

*"Outdoor Recreation for America" ORRRC. January 1962, p. 96.

This system of classification was used as a planning and design tool in the preparation of a broad development plan for this report. Areas were classified into their existing and/or proposed recreation uses, keeping in mind physiographic characteristics and socio-economic factors which may influence or be influenced by recreation.

Recreation activity areas ranging from intensive developments for large numbers of people to "primitive" or "scenic" areas suitable for limited use were designated. Although this classification system is very broad and pertains mainly to public lands, the overall plan could serve as a guide for recreation classification for private areas as well.

2. RECREATION DEVELOPMENT CENTERS

As part of a broad development plan, seven centers are proposed which have the potential for development as intensive year-round recreational bases. The following criteria were considered in the selection of these centers:

a. The center would be compatible with adjacent recreation land uses, as determined by the resource classification.

b. The centers would be on the fringes of, or adjacent to, large areas of natural environment. They would not reduce the quality of these lands but would enhance the recreational opportunities.

c. A variety of natural resources exist in the vicinity of the center suitable for year-round recreational development.

d. Existing and proposed access routes would adequately serve the center.

e. Maximum benefits could be realized from services provided by nearby small urban centers.

The proposed recreation development center locations are shown on Figure 5. Facilities and expected visitation are summarized for each center in Table VII, which follows the descriptions.

Otocsin - This center is located in Clearfield County adjacent to Interstate 80 and is proposed for development under sponsorship of the Commonwealth of Pennsylvania. Planned for intensive recreation development, the area has been referred to as a "southern gateway" to recreation in north-central Pennsylvania. Included in the plan are three major activity areas: Lake Otocsin, Elliott Interchange, and the Wilderness Area. Facilities at Lake Otocsin

would include marinas, picnic grounds, beaches, campgrounds, cabins, a resort lodge, a riding stable, and a golf course. The Elliott Interchange Area would contain the major service facilities including a shopping center, three motels, a tree nursery, and an administrative site. Other development would include two golf courses, cultural and historical centers, a honeymoon resort, a ski area, a children's zoo and fantasy forest, a wildlife park, a riding stable, and a scenic railroad. Adjacent to the Wilderness Area would be a firing range, and in the Wilderness Area would be riding and hiking trails, fishing lakes, and primitive camp sites. To be developed with private capital, this recreation center will greatly influence the economy of the Clearfield-DuBois area. Initial planned development is expected to attract 7,500,000 visitors annually, creating approximately 950 new jobs directly associated with the development.

Interstate 80 will provide direct access from the east and the west, and nearby U.S. Routes 219 and 220 will provide access from the north and south.

Susquehannock - Located near Galeton in Potter County, this center would offer a variety of recreational opportunities. Three potential reservoirs, shown on Figure 5, would be developed for recreational use. They would also provide low flow augmentation to enhance recreational uses of Pine Creek during drought periods. Existing recreation sites in the area include Lyman Run State Park, Cherry Springs and Patterson Picnic Areas, and Denton Hill State Park (also developed for skiing). The State Historical Commission is presently developing a lumber museum near Denton Hill. Other development would include an airport-motel resort complex near the present Cherry Springs Airport. An additional winter sports development offering tobogganing, snow-mobile riding, skating, skiing, and snow play would be developed along U.S. Route 6 near Denton Hill. This area could serve as a trail head for riding and hiking into the adjacent state forests and game lands, and for the proposed Tioga Wilderness Area and the Pine Creek "Scenic" River.

Access to the area would be by U.S. Route 6 and the proposed State Scenic Route 44.

Tioga-Hammond - This center in Tioga County includes the two reservoirs of the planned Tioga-Hammond project of the Corps of Engineers and the recreation sites adjacent to them. The Cowanesque Reservoir project near Lawrenceville would be included, if a usable pool is developed. Proposals for the area include a future recreation reservoir on Mill Creek, a winter sports site in the vicinity of Hills Creek, and a country-club type resort and trail development. The 13,000 acres of state game lands adjacent to the planned Tioga-Hammond reservoir have a potential for year-round recreational use. Development could include riding and hiking trails, primitive and organization campgrounds, and winter sports development.

AD-A041 387 CORPS OF ENGINEERS CINCINNATI OHIO F/G 8/6
DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. MAIN REPORT. PART--ETC(U)
NOV 69

UNCLASSIFIED NL

6 OF 7
AD
A041387

Pollution of the Tioga River from acid mine drainage presently limits recreation use of these waters and will affect recreation visitation at the planned Tioga-Hammond Project. Pollution abatement programs will be necessary if the full recreation potential of this area is to be realized.

This area is a short drive from the large urban areas of Corning and Elmira, New York, and is accessible by U.S. Route 15.

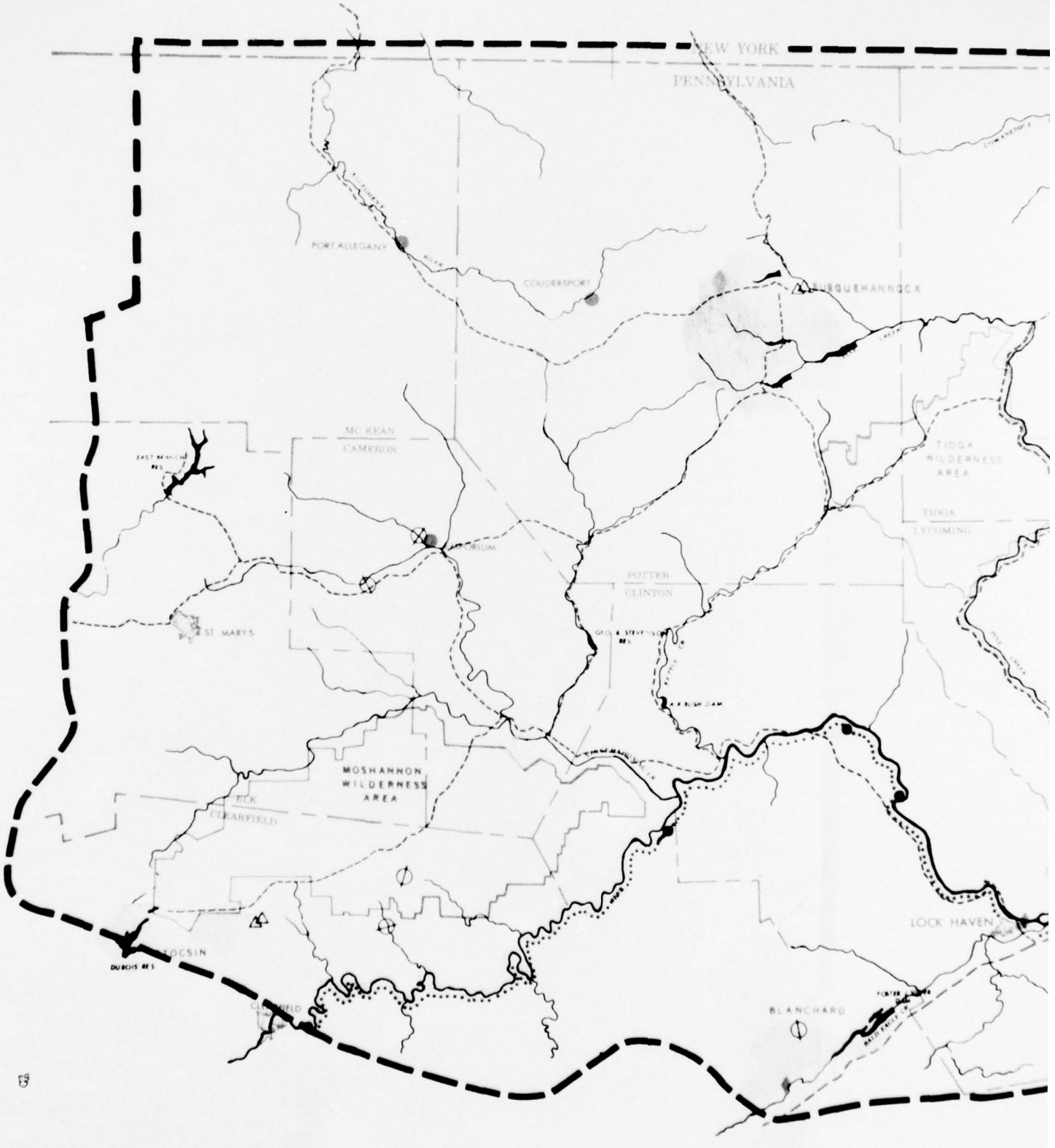
Mt. Pisgah - Located approximately 12 miles west of Towanda, this center is currently being studied by the Commonwealth and by Bradford County for two adjacent parks. A reservoir would be developed on Mill Creek providing slack water recreational opportunities. The forested Mt. Pisgah area offers development for camping, trails, nature study, and for a winter sports site offering skiing, sledding, and snow play. Other development could include vacation farms, a golf course, and motel-lodge facilities.

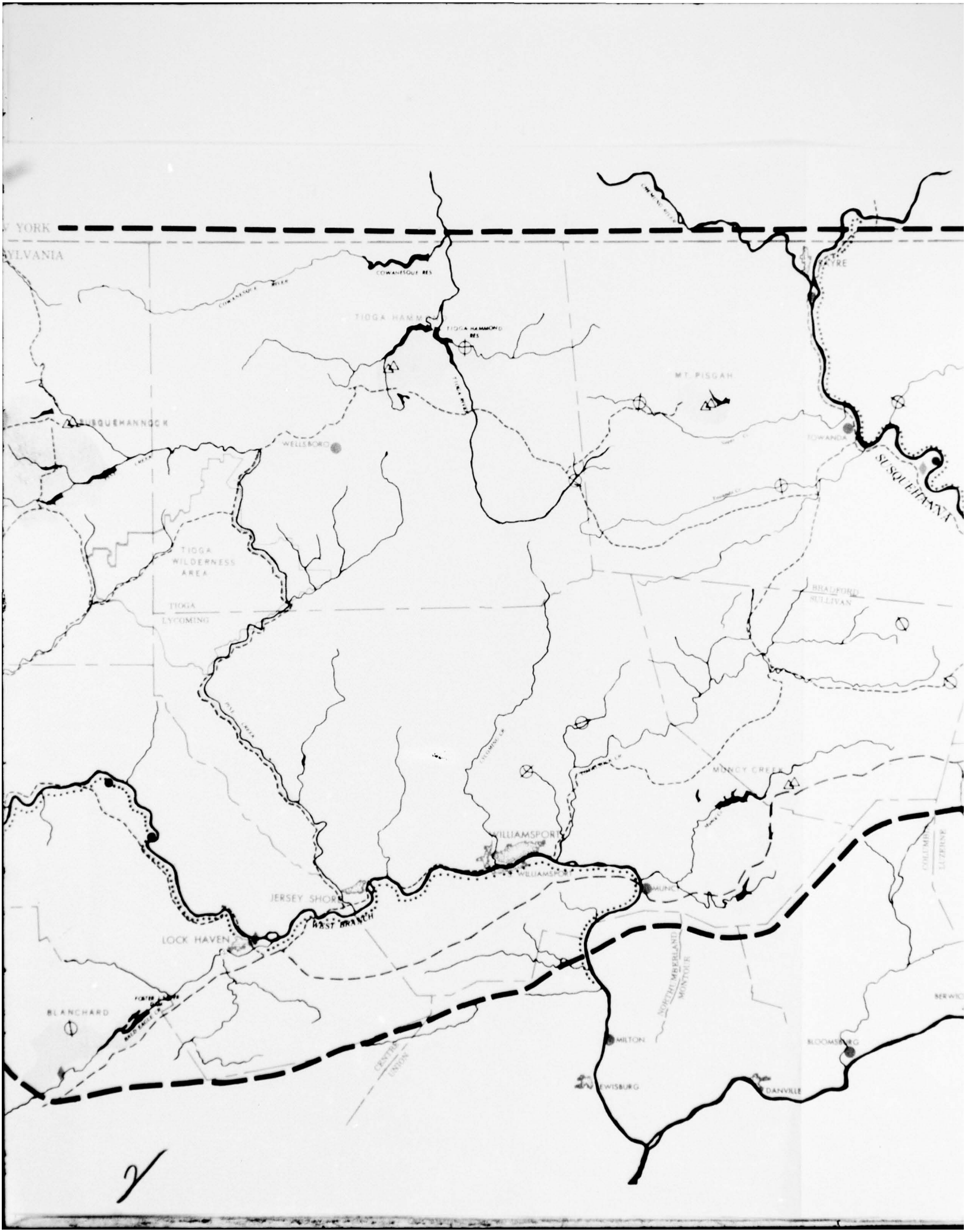
Access to the area would be easily gained over U.S. Routes 6 and 220.

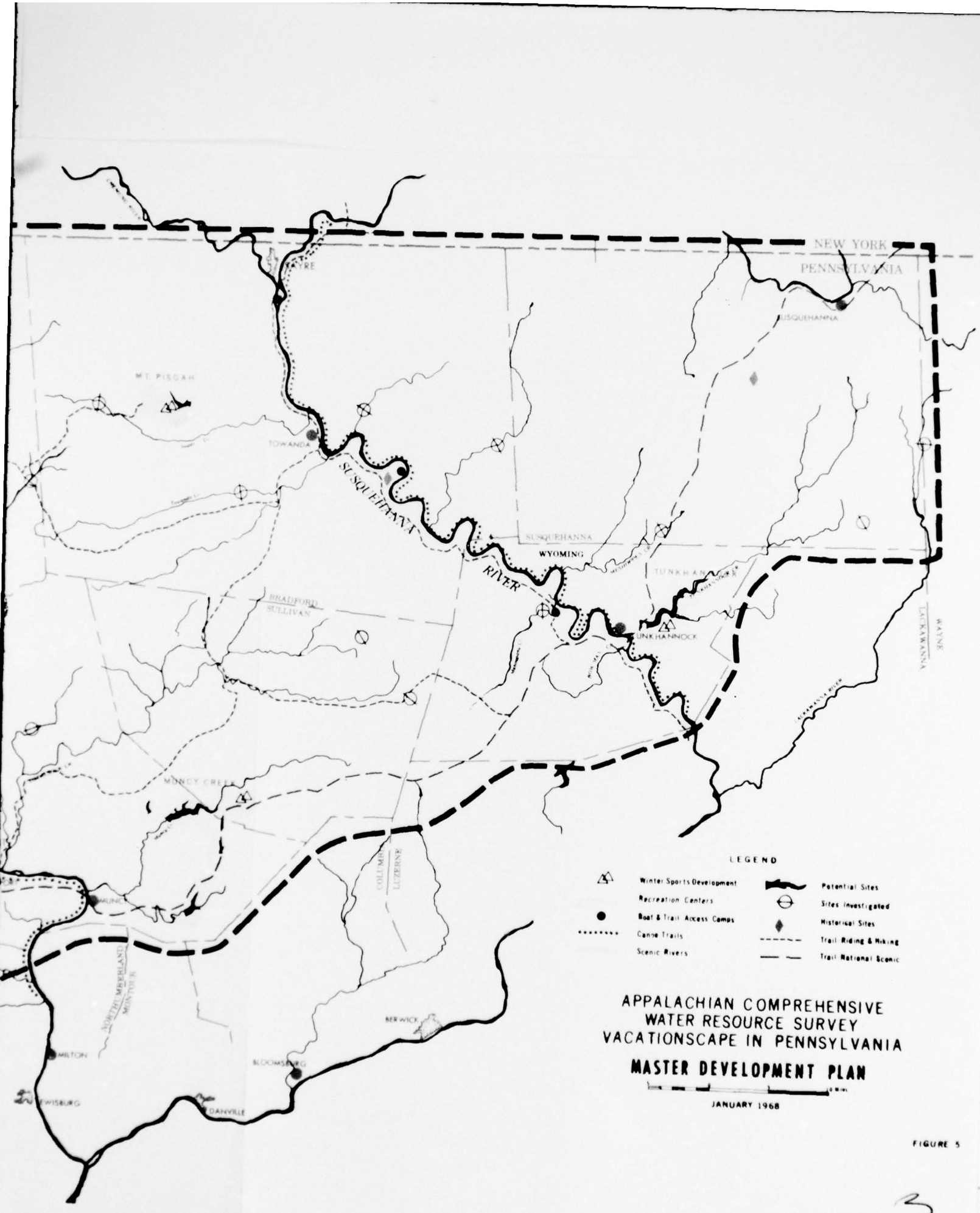
Tunkhannock - Planned around a 1,600-acre reservoir on Tunkhannock Creek in Wyoming County, this center would include marinas, beaches, camp and picnic grounds, and other water-associated facilities. A winter sports site would be developed on Osterhout Mountain. Motel-golf course resort areas presently located in the area would be expanded. Because of its proximity to the Scranton-Wilkes-Barre metropolitan area, day-use facilities would be emphasized. Facilities at this center would be augmented by state park development of the nearby sites being studied at Springville and Wallsville. Seasonal and year-round residential communities could be planned as part of the complex of development.

Access would be by U.S. Route 6 and nearby Interstate 81. An airport and railroad at Tunkhannock could also serve the area.

Muncy Creek - This center would be located in the southeastern portion of the study area in Lycoming and Sullivan Counties. The towns of Williamsport, Montoursville, Muncy, and Hughsville, totaling more than 60,000 in population, are within 15 miles of this area. Included for reservoir development would be a reservoir on Muncy Creek, a reservoir near Moreland on Little Muncy Creek, and a small reservoir on Beaver Run, as shown on Figure 5. Recreational facilities would be developed adjacent to these bodies of water with access roads and trails


NEW YORK
PENNSYLVANIA
PORT ALLEGANY
COUDERSPORT
SUSQUEHANNOCK
MC KEAN
CAMERON
TIOGA
WILDERNESS
AREA
TIOGA
LYCOMING
POTTER
CLINTON
ST. MARYS
MOSHANNON
WILDERNESS
AREA
CLEARFIELD
DUBOIS RES
BLANCHARD


COWANESQUE RES
TIOGA HAMMOND RES
MT. PISGAH
WELLSBORO
TOWANDA
SUSQUEHANNA
TIOGA WILDERNESS AREA
TIOGA
LYCOMING
BRADFORD
SULLIVAN
MUNCY CREEK
WILLIAMSPORT
JERSEY SHORE
LOCK HAVEN
BLANCHARD
MILTON
LEWISBURG
BLOOMSBURG
DANVILLE



APPALACHIAN COMPREHENSIVE
WATER RESOURCE SURVEY
VACATIONSCAPE IN PENNSYLVANIA

MASTER DEVELOPMENT PLAN

JANUARY 1968

FIGURE 5

3

connecting each of the sites. A portion of the North Country National Scenic Trail* would traverse this center. A winter sports site is presently being considered at North Mountain. U.S. Route 220 would be relocated along a scenic ridge overlooking the Muncy Creek Reservoir. The area also offers summer and year-round resort community development opportunities, as well as country-club type recreational development.

Access would be by the proposed Appalachian Corridor P near Muncy and an improved U.S. Route 220.

Blanchard - This center is located in Centre County with facilities presently being constructed along Bald Eagle Creek, at the Blanchard Reservoir Project. Three recreation areas will be developed adjacent to this 1,730-acre reservoir. An additional reservoir with recreation facilities would be developed on Little Marsh Creek. The Eagle Iron Works and Curtin Village would be restored as historical sites. The proposed North Country National Scenic Trail would be located adjacent to the area. State Game Lands exist within the center and offer additional recreation potential.

Interstate Highway 80 and U.S. Route 220 will provide good access to the center.

*"Trails for America." USDI-BOR. 1966

TABLE VII

RECREATION DEVELOPMENT CENTERS

Site	Area (Acres) Total	Water	Annual Visitation Rec-days	Status
		OTOCSIN*		
Lake Otocsin		1,400		Planned
Lodge, Cabins				
Marinas				
Campgrounds				
Beaches,				
Picnic Areas				
Riding Stables				
Golf Course				
Elliott Interchange				Planned
Administration Area				
Shopping Center				
Motels				
Cultural Center				
Historical Center				
Golf Courses				
Zoo, Wildlife Park				
Ski Area				
Scenic Railroad				
Honeymoon Retreat				
Riding Stables				
Wilderness Area				Planned
Campgrounds				
Trails				
Fishing Lakes, Several		10-30 Ea.		
TOTAL			7,500,000 (1970)	

*Planning by Community Planning Services, Inc., Monroeville, Penna.

TABLE VII (Cont'd)

Site	Area (Acres) Total	Water	Annual Visitation Rec-days	Status
		SUSQUEHANNOCK		
Lumber Museum			50,000	Planned
Galeton Res. #1		300	150,000	Proposed
Galeton Res. #2		200	100,000	"
Walton Res.		160	75,000	"
Motel, Lodge, Resort (Airport Access)			100,000	"
Winter Sports Area			25,000	"
Riding, Hiking Trails				"
Lyman Run Park		40	50,000	Existing
Denton Hill Ski			50,000	"
Cherry Springs Picnic			55,000	"
Patterson Picnic			5,000	"
Susquehannock Forest			115,000	"
Game Land #64			1,000	"
TOTAL			776,000	
		TIOGA-HAMMOND		
Tioga-Hammond Res	7,217	1,210	670,000	Planned
Recreation Areas				"
Wildlife Area				
Winter Sports Area			50,000	Proposed
Lodge-Resort			100,000	"
Mill Creek Res.		500	150,000	"
Riding-Hiking Trails				"
Hills Creek Park		140	100,000	Existing
Game Lands			4,000	"
TOTAL			1,074,000	
		MT. PISGAH		
Mill Creek Park	2,000	100	300,000	Planned
Mt. Pisgah Park	600		100,000	"
Winter Sports Area			50,000	Proposed
Lodge-Resort			100,000	"
Riding-Hiking Trails				"
Vacation Farms				"
TOTAL			550,000	

TABLE VII (Cont'd)

Site	Area (Acres) Total	Area (Acres) Water	Annual Visitation Rec-days	Status
		TUNKHANNOCK		
Tunkhannock Res.		1,600	700,000	Proposed
Winter Sports Area			50,000	"
Lodge-Resort			200,000	"
Riding-Hiking Trails				"
TOTAL			950,000	
		MUNCY		
Muncy Creek Res.		1,300	300,000	Proposed
Little Muncy Res.		700	350,000	"
Beaver Run Res.		50	50,000	"
North Mountain Winter Sports Area			100,000	"
Lodge-Resort			200,000	"
Riding-Hiking-Biking Trails				"
Scenic Highway				"
Game Lands				Existing
TOTAL			1,000,000	
		BLANCHARD		
Blanchard Res.	7,496	1,730	650,000	Planned
Wildlife Area				"
Little Marsh Creek Res.		400	200,000	Proposed
Eagle Iron Works and Curtin Village Historical Site			50,000	"
Riding-Hiking Biking Trails				"
Game Lands				Existing
TOTAL			900,000	

3. ACCESS AND MOVEMENT

Successful development of the recreational resources of the study area is highly dependent upon an improved transportation system. Present planning includes substantial highway improvement which will allow for increased traffic volumes along primary routes of travel. Completion of the Keystone Shortway (Interstate 80) and construction of Appalachian Corridors in the vicinity of Williamsport and north to New York State will provide access for millions of recreationists. East-west traffic could be improved by developing U.S. Route 6 as a four-lane controlled access highway and U.S. Routes 219 and 220 to similar standards to increase north-south traffic volumes. Other highways suitable for development as parkways and scenic highways exist within the study area and should be considered as part of a plan to encourage travel by recreationists. One route, the section of State Route 44 located between Jersey Shore and Sweden Valley should be classified as a State Scenic Highway. More detailed study will be necessary to determine the location and extent of additional scenic roads and parkways throughout the Vacationscape area. Standards of development should emphasize the design, placement, and treatment of the right-of-way as well as protection of the scenic corridor, including land use and development, site planning, design of structures, and control of outdoor advertising. The size of commercial vehicles using this route should also be restricted.

4. "SCENIC" RIVERS

The recreation and scenic values of the study area could be enhanced by preservation of certain major stream and river reaches in a free-flowing condition and in a natural setting. Legislation is presently pending before Congress which would designate sections of three streams in the study area for further investigation for possible inclusion as a part of a nationwide system of "scenic" rivers. They include a 42-mile segment of Pine Creek from Ansonia to Waterville, 88 miles of the West Branch Susquehanna from Clearfield to Lock Haven, and those portions of the main stem of the Susquehanna from Cooperstown, New York, to Pittston, Pennsylvania, which fall within the study area (approximately 110 miles).

Development and management plans for these streams should include zoning, scenic easements, and fee acquisition of selected areas to provide a scenic protective zone for the waterways. In addition, there should also be private and public facilities, access compatible with the character of the particular river or stream section, and joint control to preserve and enhance the

natural character of the areas. Pollution abatement programs would constitute a major portion of the effort to enhance the West Branch Susquehanna to make it suitable as a scenic river.

5. WILDERNESS AREAS

As the forested areas of north-central Pennsylvania come under more intensive use from various activities, there will be a need for more detailed classification and management of the resources. Some of these forested lands are presently in a semi-wilderness condition with few roads, no commercial development, and a sparse resident population. Two areas, namely the Moshannon and the Tioga Wilderness Areas, as shown in the Development Plan, are proposed for Wilderness classification. Further study would determine the feasibility of managing all or portions of these areas to establish a climax type of forest environment with restoration and abatement programs to eliminate pollution and restore strip-mined areas. Forest management policies would be altered to restrict mechanical means of transportation, development of new roads, commercial ventures, and tourist and sportmen's lodges. Certain existing roads would remain in use with services and residential areas allowed under a zoning plan. Wilderness areas would be large enough and so located to give the recreationist a sense of being away from civilization. Development would be restricted to extensive riding and hiking trails, primitive type campgrounds, pack stations, and hunting and fishing habitat enhancement. The proposed areas would provide over 200,000 wilderness acres offering unique recreation experiences for the visitor from the nearby centers of Otocsin and Susquehannock, and from other recreation areas.

6. GENERAL DEVELOPMENT

Future recreation demands will require land and water resource development in addition to the proposals outlined in the previous paragraphs. A number of sites which were investigated and determined as having good potential for impoundments for recreational development are noted on Figure 5. These impoundments would vary in size from 50 to 2,500 surface acres and could provide a base for recreation development by varying intensity. The Commonwealth is presently developing a 3,000-acre pool for recreational use by constructing a rubber "Fabridam" on the Susquehanna River at Sunbury. Within the study area, a potential site for a similar type of dam exists on the West Branch Susquehanna River at Williamsport. A long, shallow recreation pool extending upstream to Jersey Shore, or beyond, could provide thousands of acres of water for recreation use.

Streamside development should include additional boat access points, marinas, parking areas, trails, and boat and trail access campgrounds. Streams should be classified and policies adopted to insure the best recreation use. Beech, Loyalsock, and Muncy Creeks should be studied with a view to permanently reserving certain portions of their reaches for white-water canoeing.

The Commonwealth is presently inventorying all existing trails as a basis for future development. A proposed system of major hiking and riding trails in the study area is indicated in Figure 5. Cost of right-of-way acquisition and development could be reduced by making use of abandoned railroads, logging roads, and utility rights-of-way wherever possible. The alignment of a section of the proposed North Country National Scenic Trail is shown traversing this area. The proposed trail system in the northern counties would connect with the planned Finger Lakes Trail in New York State. There is also a potential for development of biking trails especially between recreation development centers and nearby urban areas.

In addition to the historical sites which would be restored within the recreation centers, two sites proposed for public acquisition are French Azilum, in Bradford County, and Old Mill Village in Susquehanna County.

7. ECONOMIC IMPACT

Goals developed for the Appalachian development program include substantial increases in population, employment, and income for the study area. Table VIII shows projected population growth for the region. It is anticipated that, through the development of a recreation industry, a portion of these goals can be met.

TABLE VIII

POPULATION GROWTH AND PROJECTION

ACTUAL			PROJECTED	
1940	1960	1980	2000	2020
356,000	380,000	568,000	725,000	997,000

Extensive economic gains in an area cannot readily be achieved by additional seasonal recreation developments. However, significant benefits can be realized through the development of year-round recreation complexes offering a diversity of activities with high-quality facilities. Expenditures at lake and reservoir facilities have been estimated by the Corps of Engineers to average 4 dollars per visitor-day. A site attracting 250,000 annual visitors

would induce expenditures of $1 million annually. Relating expenditures to induced employment, a report on Economic Development by Litton Industries indicated that employment was generated at the rate of one employee for every $20,640 spent on recreation visits. This relationship yields an employment figure of 194 persons for every one million visitor-days.

To realize the maximum benefits from recreation developments, visitors must be attracted in large numbers and for extended periods of time.

V. SUMMARY

1. GENERAL CONCLUSIONS

The mountains, forests, valleys, and streams of the study area offer an excellent potential for increased year-round recreation development. In 1963, recreation visitation was approximately 3.5 million recreation-days at public facilities. Development, as outlined in this study, could increase visitation 10 to 14 million recreation-days, including private facilities, and still retain the inherent natural values of the resources.

Nearly 40 million people living in the surrounding metropolitan areas are within one day's drive of the study area. The completion of planned and proposed highway systems will provide direct access to all the proposed recreation development centers. Improved rail service to recreation centers will be a long-term necessity.

Recreation resource development could provide substantial economic benefits to the area as well as satisfying part of the public demand for outdoor recreational opportunity. Approximately 2,300 man-years of employment would be generated, including both permanent and seasonal work. However, more detailed planning is required to guide the necessary investments to yield the optimum return in recreational opportunity and economic benefits.

2. RECOMMENDATIONS

Considering this report as the first phase of a comprehensive recreational plan for north-central Pennsylvania, more detailed planning should follow at an early date with objectives as follows:

a. Development of additional recreation resources with emphasis on several year-round recreational centers with slack-water impoundments.

b. Improved access by accelerated improvements of the highway system, and development of numerous scenic highways.

c. A pattern of "scenic" rivers and wilderness areas developed for appropriate recreational use.

d. A schedule of combined private and public investments to develop the recreational potential with emphasis on maximizing the economic benefits to the area.

BIBLIOGRAPHY

Community Planning Services, Inc.
Otocsin. U.S. Department of Commerce (Unpublished).

Litton Industries, Economic Development Division.
A Preliminary Analysis for an Economic Development Plan. Litton Industries, Washington, D.C. 1965.

Outdoor Recreation Resources Review Commission.
ORRRC Study Report. U.S. Government Printing Office, Washington, D.C. 1962. 25 Vols.

Pennsylvania Fish Commission.
Boating Guide to Pennsylvania Waters. Harrisburg.

Pennsylvania State Planning Board.
Regional Development Reconnaissance. Harrisburg, 1965.
Statewide Outdoor Recreation Plan. Harrisburg, 1966.

U.S. Department of Commerce.
A Proposed Program for Scenic Roads and Parkways. U.S. Government Printing Office, Washington, D.C. 1966.
The Skier Market, Northeast North America. Clearinghouse For Federal Scientific & Technical Information, Springfield, Virginia, 1963.

U.S. Department of Interior, Bureau of Outdoor Recreation.
Outdoor Recreation Trends. U.S. Government Printing Office, Washington, D.C. 1967.
Supply of Outdoor Recreation Resources of Appalachia. 1966.
Trails for America. U.S. Government Printing Office, Washington, D.C. 1966.
A Report on Outdoor Recreation Demand, Supply, and Needs in Appalachia, 1967.

DEVELOPMENT
OF
WATER RESOURCES
IN
APPALACHIA

MAIN REPORT
PART II
SHAPING A PLAN

CHAPTER 5 - WATER SUB-REGION C TODAY

TABLE OF CONTENTS

Par.	Subject	Page II-5-
	SECTION I - THE REGION TODAY	
1	POLITICAL	1
2	PHYSICAL	1
	Physiography and Geology	1
	Drainage	2
	Stream Characteristics	2
	Climatology	7
	Flood Characteristics	10
	Streamflow Data	11
	Droughts	12
	Transportation Facilities	12
3	NATURAL RESOURCES DEVELOPMENT	15
	Human	15
	Minerals	25
	Lands	25
	Environmental Aspects	28
	Water Resources Development - Federal	30
	Corps of Engineers	30
	Reservoir Projects	30
	Studies Underway	35
	U.S. Department of Agriculture	35
	Watershed Projects	35
	Land Use Programs	35
	Other Water Resources Programs	36

CHAPTER 5 - WATER SUB-REGION C TODAY

TABLE OF CONTENTS
(cont'd)

Par.	Subject	Page
	Water Resources Development - Non-federal	II-5-36
	State and Local Projects	36
	Reservoirs	36
	Studies Underway	36
	Water Supply and Sewage Treatment Facilities	37
	SECTION II - SOCIO-ECONOMIC STRUCTURE	
4	INTRODUCTION	38
	Planning Devices	38
	Economic Characteristics	42
	Local Attitudes	52
	Capital Availability	52
5	GROWTH AREAS	58
	Buchanan-Roanoke Growth Area	58
	Covington-Clifton Forge Growth Area	59

CHAPTER 5 - WATER SUB-REGION C TODAY

LIST OF TABLES

Table No.	Title	Page
5-1	Stream Characteristics	II-5- 7
5-2	Climatological Data	8
5-3	Flood Data	10
5-4	Runoff and Flood Data	11
5-5	Flow Deficiency Periods, Parr, Virginia Gage	12
5-6	Urban-Rural Population Distribution by Counties	19
5-7	Population in Water Sub-region C, 1940-1967	19
5-8	Pertinent Data, Gathright Dam and Reservoir	30
5-9	Water Supply Facilities	37
5-10	Sewage Treatment Facilities	37
5-11	Employment by Sectors for 1950 and 1960, Virginia State Planning Sub-region 28	54
5-12	Socio-Economic Characteristics, Virginia State Planning Sub-region 28	57

LIST OF FIGURES

Figure No.	Title	Page
5-1	Location Map	3
5-2	Physical Features	5
5-3	Precipitation Data	9
5-4	Highways & Airports	13
5-5	Railroads	17

LIST OF FIGURES
(cont'd)

Figure No.	Title	Page
5-6	Distribution of Urban, Rural Non-Farm and Farm Population	II-5-16
5-7	Population Distribution by Age and Sex	21
5-8	Higher Education Facilities	23
5-9	Educational Attainment in Water Sub-region C Compared to United States	20
5-10	Public Land Holdings	27
5-11	Trends in Size and Number of Farms and Land in Farms	28
5-12	Scenic and Historical Sites	31
5-13	Water Resources Development	33
5-14	Planning Areas	39
5-15	Employment by Major Sectors	42
5-16	Manufacturing Employment	43
5-17	Value of Farm Products	45
5-18	Unemployment	47
5-19	Per Capita Income Comparisons	49
5-20	Family Income Distribution	50
5-21	Sources of Income	51
5-22	Financial Situation	55

CHAPTER 5 - WATER SUB-REGION C TODAY

SECTION I - THE REGION TODAY

1. POLITICAL

Sub-region C (See Figure 5-1) is comprised of five counties in western Virginia; Alleghany, Bath, Botetourt, Craig and Highland. The sub-region lies principally in the headwater of the James River which drains eastward to the Atlantic Ocean. Small portions of the sub-region are also drained by the headwaters of the New, Potomac and Roanoke Rivers.

The major cities within the sub-region are Covington and Clifton Forge, both in Alleghany County, although politically independent. Monterey, Warm Springs, Fincastle, Buchanan, and New Castle are the principal small towns. Lynchburg, Lexington, and Roanoke are the major cities located immediately adjacent to the sub-region.

In recent years, several planning authorities have been established in the sub-region. Alleghany, Bath, and Botetourt counties have active planning commissions as do the independent cities of Covington and Clifton Forge. Botetourt County is also a member of the Roanoke Valley Regional Planning Commission. At the state level, the Divisions of Industrial Development and Water Resources contribute to both planning for economic development and development of water resources.

2. PHYSICAL

Physiography and Geology

The sub-region lies almost entirely within the Valley and Ridge physiographic province which is characterized by parallel ridges and valleys that trend in a northeastward direction (See Figure 5-2). The western portion lies in the rugged and scenic Allegheny Mountains, where the ridges attain elevations from 3200 to 4600 feet mean sea level. To the east the topography moderates somewhat in the area between the Allegheny and Blue Ridge Mountains with ridges varying in elevation from 700 to 2200 feet. The Blue Ridge Mountains cross the lower southeast edge of the sub-region where again the topography becomes rugged with peaks to an elevation of 3000 feet.

The surface is underlain by rocks that range in age from Pre-Cambrian to Devonian. The older rocks outcrop in the eastern part of the sub-region, with the more recent outcroppings occurring in the west. The rocks are predominantly shale and limestone, with interbedded sandstone and siltstone. Generally, sandstones form the ridges while limestone formations underlay the valleys. As most of the important streams in the Ridge and Valley

areas are antecedent streams and have entrenched their courses across the ridges, topographic conditions are favorable for dam construction.

Drainage

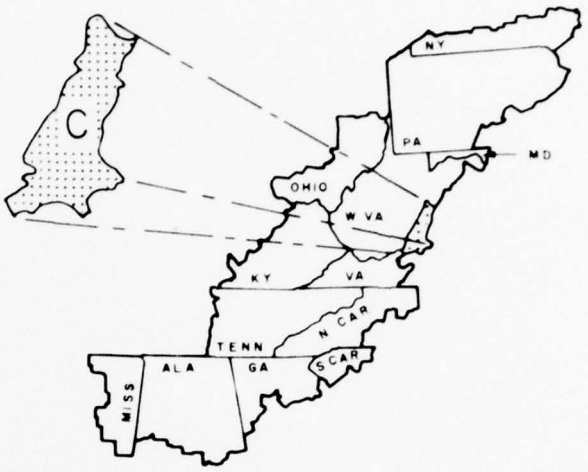
Of the 2,293 square miles within the boundaries of Sub-region C, 2,075 are in the James River Watershed. The remaining drainage includes 107, 43, and 68 square miles in the Potomac, New and Roanoke River Basins, respectively. Because of the negligible effect of the latter watersheds on the sub-region, only the hydrological characteristics of the James River Basin were considered as influencing its water resource development.

The portion of Sub-region C contributing to flow in the James River Basin represents about 22 percent of the total James River Watershed. Nearly 8,000 sq. miles of the lower James River Basin are affected by the contributing watershed within the sub-region. Such major metropolitan centers as Lynchburg and Richmond, located downstream from the sub-region, rely on the James River for water supply withdrawals.

Stream Characteristics

The principal streams of the sub-region are the Jackson and Cowpasture Rivers, which join to form the James River 3 miles below Clifton Forge; and Craig Creek, which enters the James River 19 miles below Clifton Forge. (See Figure 5-1.) Stream slopes vary from a moderate 10 feet per mile at the lower end of the basin to 38 feet per mile in the precipitous Allegheny portion of the region. Water quality is generally good in the sub-region, except in the Jackson River between Covington and Clifton Forge, where industrial waste loads far exceed the assimilative capacity of the stream. Other areas with major pollution problems outside the sub-region are the Lynchburg vicinity and the estuary of the James River. As discussed later, the Gathright reservoir, when completed, will improve water quality in these areas. Drainage areas and mileages along the main stream and selected tributaries are shown in Table 5-1.

Monterey
HIGHLAND
McDowell
Staunton
BATH
Warm Springs
Mitchelltow
Hot Springs
Marlboro Springs
Healing Springs
Falling Spring
Clifton Forge
Iron Gate
Lowmoor
Lexington
Covington
ALLEGHANY
Eagle Rock
Hinton
Glasgow
BOTETOURT
Buchanan
New Castle
Fincastle
CRAIG
Troutville
Lynchburg
Salem
Roanoke
Vinton
CARVIN COVE WATERSHED RESERVOIR
SMITH MOUNTAIN LAKE
10 5 0 10 20 30
SCALE IN MILES



VICINITY MAP

O Staunton

gton

O Scottsville

JAMES

JAMES RIVER BASIN

Richmond

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION C

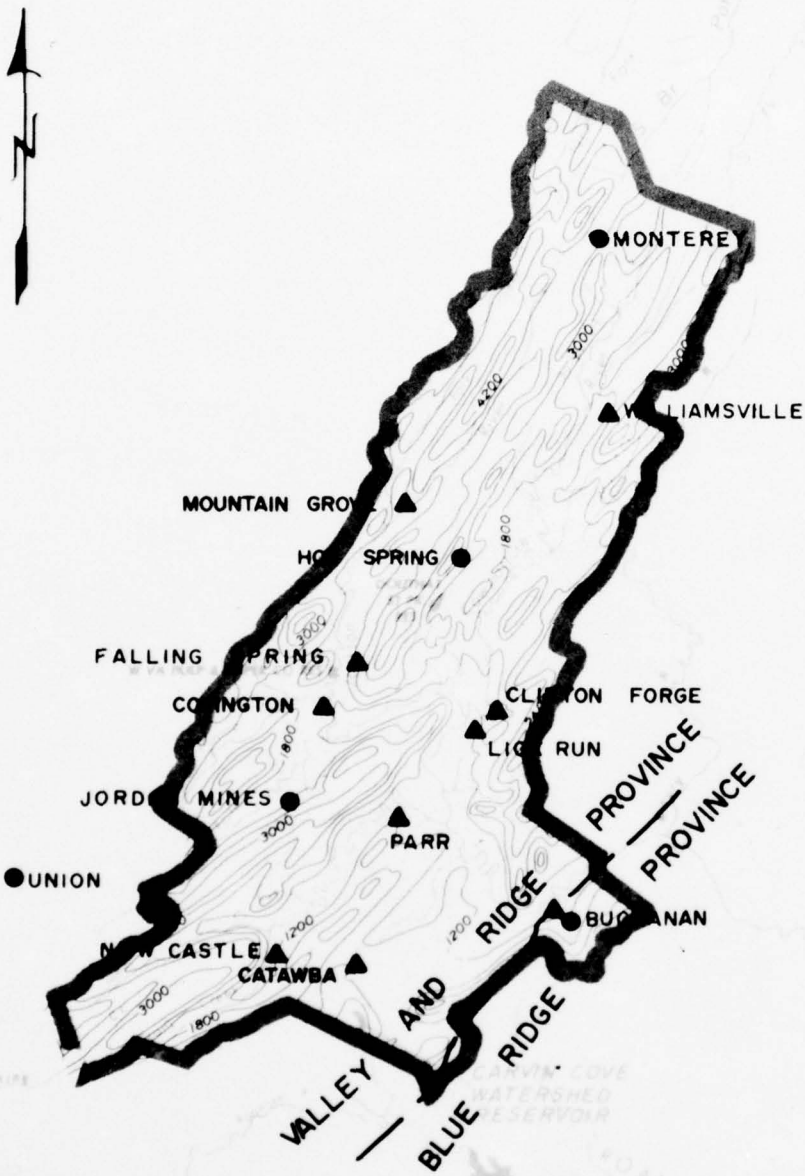
LOCATION MAP

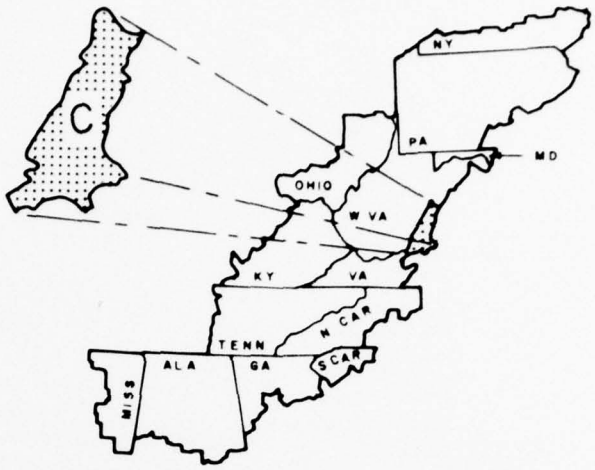
0 10 20 30 40 50

SCALE IN MILES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-5-3 FIGURE 5-1


N
MONTEREY
WILLIAMSVILLE
MOUNTAIN GROVE
HOT SPRING
FALLING SPRING
COVINGTON
CLIFTON FORGE
LIGHT RUN
JORDAN MINES
PARR
UNION
BUCHANAN
NEW CASTLE
CATAWBA
VALLEY AND RIDGE PROVINCE
BLUE RIDGE PROVINCE
CONTOUR INTERVAL 600 FEET
10 5 0 10 20 30
SCALE IN MILES



VICINITY MAP

LEGEND

- PRECIPITATION STATIONS
- STREAM GAGING STATIONS
- PHYSIOGRAPHIC BOUNDARY

CONTOUR INTERVAL 600 FEET

0 10 20 30 40 50

SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION C

PHYSICAL FEATURES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-5-5 FIGURE 5-2

TABLE 5-1
STREAM CHARACTERISTICS

Location	Drainage Area (sq. mi.)	Miles Above Mouth	Reach Length (miles)	Average Slope (ft./mi.)
		JAMES RIVER		
Sub-Region C Boundary (1)	2,168	288.7	145.5*	9.7*
Buchanan Gage	2,084	301.2	133.0*	10.3*
Head of River	1,367	339.7	94.5*	16.4*
		JACKSON RIVER		
Mouth (Head of James River)	907	0	94.5*	16.4*
Falling Springs Gage	409	35.8	58.7*	23.5*
Gathright Dam Site	344	43.5	51.0*	26.9*
		CRAIG CREEK		
Mouth (Mile 323.7 James River)	374	0	72.0	
Parr Gage	331	11.8	60.2	12.0
Hipes Dam Site	327	14.8	57.2	

*Computed up Jackson River and Back Creek.
(1) Includes 138 square miles of drainage flowing into sub-region and excludes 45 square miles in the sub-region which drain into the James River below the boundary of Sub-region C.

Climatology

The region is adequately covered by climatological stations. There are 14 stations in or near the region with 30 or more years of record. (See Figure 5-2.) Four of these stations were selected as representative of the sub-region and their records are summarized in Table 5-2.

TABLE 5-2
CLIMATOLOGICAL DATA FOR SELECTED STATIONS

Station	Elev. (feet msl)	Record Began	Average Annual Temp. (F.)	Average Annual Precip. (in.)	Average Annual Snow-fall (in.)	Maximum 24-hour Precip.
Buchanan, Va.	875	1893*	56.8	44.20	18.5	5.68
Hot Springs, Va.	2197	1892	51.2	41.38	25.0	5.85
Monterey, Va.	2910	1894*	48.7	39.23	34.8	4.50
Union, W. Va.	1975	1902	52.1	36.23	23.9	4.10

*Broken record

Sub-region C lies within the temperate zone, experiencing warm summers and rigorous, but not severe, winters. Extreme temperatures range from 107° recorded at Buchanan, Va., to 20 below zero at Hot Springs, Va. The mean annual temperature of the region is 53°. The average annual precipitation over the sub-region is 41 inches, and is reasonably well distributed throughout the year. Rainfall within the sub-region is generally less than in the adjacent regions to the east and west of it, as the pattern of precipitation is influenced by the Allegheny and Blue Ridge Mountains. However, rainfall is usually adequate and is substantially above the average for the coterminous United States. Annual and monthly rainfall extremes for the selected stations are shown on Figure 5-3.

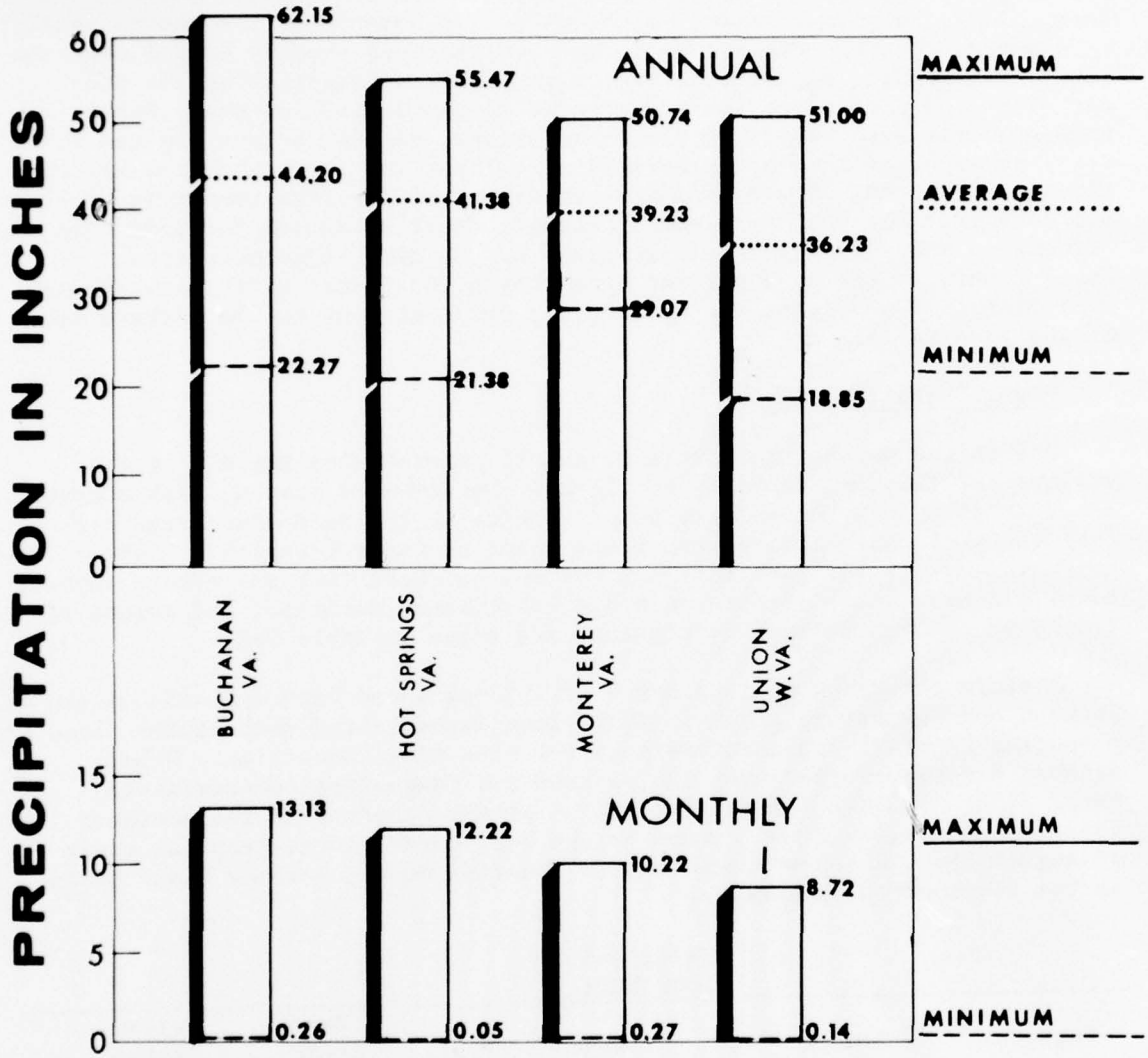


Figure 5-3 Precipitation Data for Selected Stations in Water Sub-region C.

Snowfall amounts throughout the sub-region vary from about 17 inches per year in the valleys to about 35 inches or more along the ridges. Snow accumulation is of little or no consequence insofar as affecting the run-off regimen of streams.

The sub-region is subject to flood-producing storms during all seasons of the year; however, the frequency of storms is significantly greater during the spring and winter months. The sustained winter and spring

storms generally produce the larger floods in the sub-region, particularly along the main streams. Although not as intense as the convectional type storm, these storms are of longer duration and usually extend over the entire sub-region, and, due to the orographic configuration of the sub-region, flood conditions are accentuated along the main stream. Summer thunderstorms also result in flood conditions, particularly along the tributary streams, as they are generally more local in nature than the spring and winter storms. South Atlantic hurricanes in the late summer and fall approach from the south and east; however, their potential for producing floods in the sub-region is diminished by the Blue Ridge Mountains. These mountains act as a barrier by shunting the storms northeastward and away from the sub-region and by inducing precipitation on the eastern side of the Blue Ridge.

Flood Characteristics

Due to the mountainous terrain, runoff concentrates rapidly in the valleys and flooding tends to be flashy. During most storms, peak stages occur about 3 to 6 hours after runoff begins in the headwater areas and from 18 to 24 hours at the downstream limit of the sub-region. Flood heights remain at or near the peak for only a short time and return rapidly to within-bank stages. Data on stage, discharge, duration, and volume of floods at two representative stations are shown in Table 5-3.

A storm occurring in late March of 1913 produced record floods on the Jackson and Cowpasture Rivers. This storm demonstrated that severe flood producing rainfall can occur west of the Blue Ridge Mountains. Other notable storms occurred over the Jackson and Cowpasture sub-basins in March 1936, May 1942, and August 1969. Severe flooding in the southern third of Sub-region C was caused by the hurricane-spawned tropical storm of August 1940, which produced record flooding on the Roanoke River Basin in the south of the sub-region.

TABLE 5-3
FLOOD DATA

Gage and Datum	Damage Stage (ft.)	Date	Gage Height (ft.)	Peak Discharge (cfs)	Days Above Damage Stage	Volume Above Base Flow	
						Ac.Ft.	In.
Jackson R.							
Falling Spring	11	Mar 13	20	50,000		98,000	4.5
1,333.49		17 Mar 36	14.74	24,700	2	50,200	2.3
		16 May 42	13.65	20,100	1	26,200	1.2
		14 Apr 49	12.97	17,800	1	34,900	1.6
		8 Dec 50	14.11	17,600	1	30,500	1.4
		12 Mar 63	12.26	14,600	1	58,900	2.7
		5 Mar 55	11.79	13,300	1	32,700	1.5
		20 Aug 69	13.36	19,000	1	Not Available	

TABLE 5-3 (Cont'd)
FLOOD DATA

Gage and Datum	Damage Stage (ft.)	Date	Gage Height (ft.)	Peak Discharge (cfs)	Days Above Damage Stage	Volume Above Base Flow Ac.Ft.	Volume Above Base Flow In.
James River Buchanan 802.90	15.8	27 Mar 13	31	105,000	2	211,000	1.9
		18 Mar 36	26.80	84,100	2	189,000	1.7
		1 Mar 02	25.0	76,000	2	322,000	2.9
		23 Jan 35	23.82	70,400	2	211,000	1.9
		13 Mar 63	22.30	61,800	2	178,000	1.6
		30 Dec 01	19.2	55,000	2	211,000	1.9
		20 Aug 69	23.40	67,100	2	Not Available	

Streamflow Data

Currently, there are 10 river gaging stations in Sub-region C. (See Figure 5-2.) In addition, some records at 5 other stations have been discontinued. Runoff throughout the sub-region varies from 14 to 16 inches annually. At Buchanan, near the exit of the James River from the sub-region, the average annual runoff is 16 inches, or about 39 percent of the average annual rainfall. The streamflow at this point averages about 1600 mgd. Data from selected gaging stations (flows based on water year) are shown in Table 5-4 (includes preliminary values of the August 1969 flood).

TABLE 5-4
RUNOFF AND FLOOD DATA

Stream and Station	D.A. (sq. mi.)	Years of Record	Annual Runoff (in.) Mean	Max.	Min.	Gage Datum (msl)	Maximum Flood Stage (ft.)	Discharge (cfs)
Back Creek Mountain Grove	131	14	17.24	22.56	12.04	1701.43	9.70	9,600
Jackson River Falling Spring	409	40	15.82	27.14	8.66	1333.49	14.74	24,700
Dunlap Creek Covington	166	37	12.82	22.90	5.51	1294.70	13.13	12,500
Craig Creek Parr	331	40	15.29	26.51	8.43	992.50	17.00	19,100
Catawba Creek Catawba	34	22	14.18	30.10	5.31	1299.96	6.58	5,670
James River Buchanan	2084	67	16.05	26.95	8.61	802.90	31.0	105,000

Droughts

Periods of droughts have been recorded in Sub-region C at stream gaging stations previously listed with the low stream flow normally occurring between July and the winter months.

Using the Parr, Virginia gage record for the period 1925 to 1960 as a representative sample, the data in Table 5-5 were compiled.

TABLE 5-5
FLOW DEFICIENCY PERIODS AT THE PARR, VIRGINIA GAGE

Period	Number of Consecutive Calendar Yrs.	Annual Average Runoff for Period in Inches	Percent of Average Runoff for Period of Record
1930	1	5.90	38%
1930-31	2	7.74	50%
1955-56	2	12.34	79%
1930-32	3	11.05	71%
1954-56	3	12.09	78%
1930-33	4	11.70	75%
1930-34	5	12.36	79%

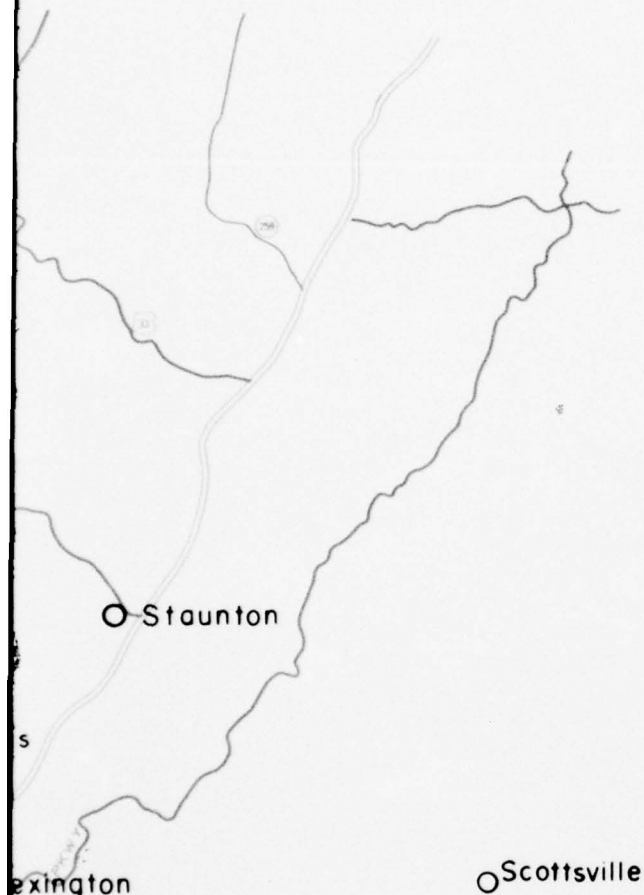
From the above information, it can be concluded that at least two drought periods occurred during the 35-year recording period. The most severe, beginning in calendar year 1930, lasted for five years.

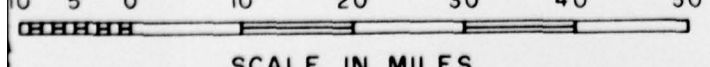
Transportation Facilities

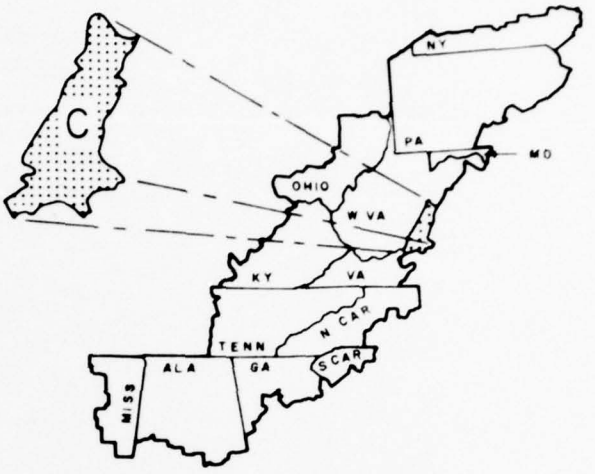
Access is good over the existing highway network and will improve following completion of north-south Interstate 81 and east-west Interstate 64, both of which will traverse the area. Interstate 81 is complete in Botetourt County and Interstate 64 in Alleghany County is scheduled for completion in 1970. The interstate system of highways is tentatively scheduled for completion in 1975. Generally, adequate access is available within the sub-region to the interstate highway system.

Of substantial importance to the recreation and tourist potential of the area are the existing Blue Ridge Parkway and the proposed Allegheny Parkway. These pleasure, scenic highways would run north-south adjacent to the area on the east and west boundaries of the sub-region. The Blue Ridge Parkway is virtually complete with the exception of a small section near Linville, North Carolina. The Allegheny Parkway in the vicinity of Sub-region C is not scheduled for any construction activity until at least 1972. The more important highways in the sub-region are shown on Figure 5-4.

N
Monterey
HIGHLAND
McDowell
Staunton
BATH
Warm Springs
Mitchelltown
Hot Springs
Millboro Springs
Healing Springs
Falling Spring
Clifton Forge
Iron Gate
Lexington
Lowmoor
ALLEGHANY
Eagle Rock
Glasgow
BOTETOURT
Buchanan
Fincastle
CRAIG
Troutville
Lynchburg
Vinton
10 5 0 10 20 30
SCALE IN MILES







VICINITY MAP

LEGEND

- Interstate Highway
- Federal Highway
- State Highway
- Appalachian Corridor
- Scheduled Prop Service

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION C

HIGHWAYS & AIRPORTS

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-5-13 FIGURE 5-4

Truck and bus service are adequate within the sub-region. Daily and overnight trucking services, both interstate and intrastate, are available to the counties of the sub-region. Major concentration of trucking companies, however, is in Alleghany and Botetourt Counties. Several companies provide bus service within the sub-region and to points outside the region including daily passenger service to Roanoke, the principal trading center.

The Chesapeake and Ohio Railway serves the counties of Alleghany, Bath, and Botetourt. In addition, Botetourt is served by the Norfolk and Western Railway. There are no railroads operating in Craig and Highland Counties. (See Figure 5-5.)

Three public airports serve the area--Ingals Field in Bath County, Covington Airport in Alleghany County, and a small landing field near Monterey in Highland County. The sourthern counties of the sub-region can also be served by the Roanoke Airport. Both Ingalls Field and Roanoke Airport offer commerical airline service. Covington Airport is available for business and private aircraft. Figure 5-4 shows the location of airports in and adjacent to the sub-region.

3. NATURAL RESOURCES DEVELOPMENT

Human

The population of Sub-Region C in 1960 was 57,085 people. Lynchburg, with a population of 54,790, and Lexington, with a population of 7,537, are just outside the Appalachian Region. The City of Roanoke, with a population of 97,110, lies just to the south of Botetourt County.

Because of the mountainous terrain, the population density of Sub-Region C is fairly low, with an average of about 25.8 persons per square mile. This compares with a state average of 113.9. The most concentrated population of the sub-region is in three areas; in and near the cities of Covington and Clifton Forge in Alleghany County and the Amsterdam Magisterial District in Botetourt County, a suburb of Roanoke. According to 1960 Census data, approximately 29 percent of the population is urban and 71 percent rural, about the reverse of the U.S. relationships. The sub-region has a large percentage of rural non-farm residents. Figure 5-6 shows the population distribution of the sub-region as compared to that of the nation.

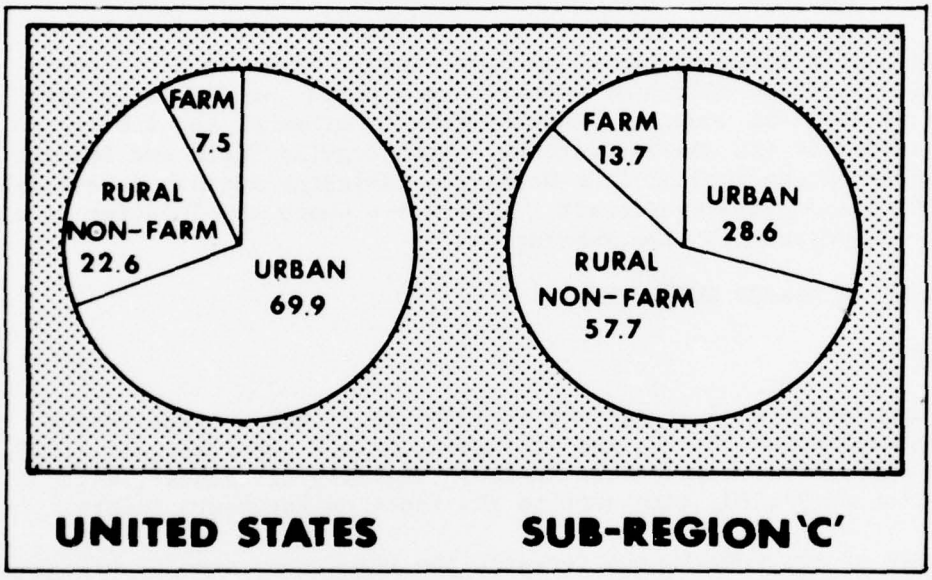
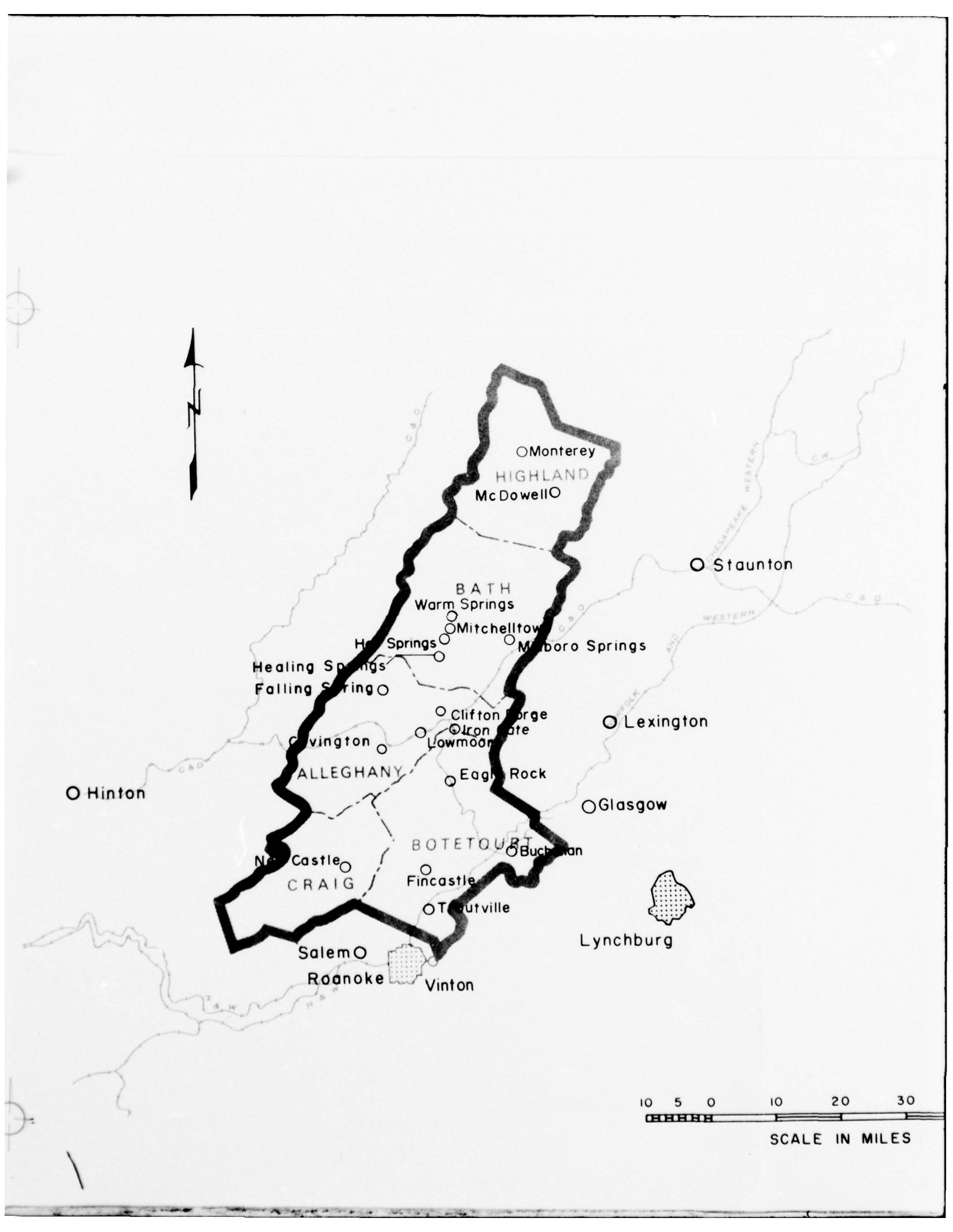
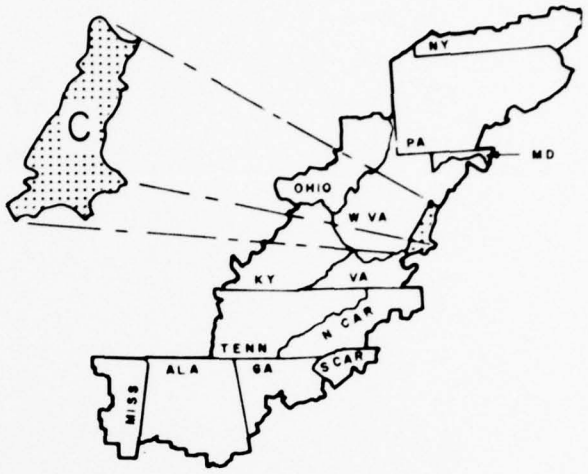


Figure 5-6 Distribution of Urban, Rural Non-Farm and Farm Population in Sub-region C compared to the United States, 1960.

The urban population in the sub-region (defined as living in towns of 2,500 or more) was found in only two cities; Covington (11,062) and Clifton Forge (5,268). Over 75 percent of the dominant rural non-farm population was located in Alleghany and Botetourt Counties. Bath, Craig, and Highland Counties contained many small communities and also had a predominant rural non-farm population. Table 5-6 shows the population distribution for each of the five counties.


Monterey
HIGHLAND
McDowell
Staunton
BATH
Warm Springs
Mitchelltow
Springs
Healing Springs
Falling Spring
Clifton Forge
Iron Gate
Lowmoor
Covington
ALLEGHANY
Eagle Rock
Lexington
Hinton
Glasgow
BOTETOURT
Buchanan
Castle
CRAIG
Fincastle
Troutville
Lynchburg
Salem
Roanoke
Vinton
C&O
CHESAPEAKE AND WESTERN
FOLK
10 5 0 10 20 30
SCALE IN MILES



VICINITY MAP

O Staunton

ngton

5 0 10 20 30 40 50

SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION C

RAILROADS

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-5-17 FIGURE 5-5

TABLE 5-6
URBAN-RURAL POPULATION DISTRIBUTION BY COUNTIES,
WATER SUB-REGION C, 1960

	Percent of Total Population (1960)		
	Urban	Farm	Rural Non-farm
Alleghany	57.4	2.2	40.4
Bath	--	22.2	77.8
Botetourt	--	20.5	79.5
Craig	--	29.4	70.6
Highland	--	49.8	50.2

From 1940 to 1960, the sub-region experienced a small but steady decline in population. However, population data for 1967 indicates this trend has been reversed, as shown in Table 5-7.

TABLE 5-7
POPULATION IN WATER SUB-REGION C, 1940-1967

Area	1940	1950	1960	1967
Botetourt - Alleghany (a)	45,596	44,700	45,173	47,366
Bath - Craig - Highland	15,835	13,817	11,912	11,631
Total Sub-region	61,431	58,517	57,085	58,997

(a) Includes cities of Covington and Clifton Forge.

The reversal is due to population increases in the growth areas of Alleghany and Botetourt Counties; whereas, the hinterland counties of Bath, Craig and Highland continue on a downward trend.

The sub-region has a population which is well balanced in age groupings when compared to the nation's population. This relationship is shown for both male and female in seven age groupings in Figure 5-7.

Facilities for retraining purposes, industrial arts classes, and apprenticeships are available throughout the five-county area. In Covington the Industrial Cooperative Training Program offers training to young people for occupations within their community. Night classes for adults are also offered in many communities.

Two two-year colleges are located in Clifton Forge. In addition, several counties adjacent to the sub-region have some of the finest colleges in the State. Figure 5-8 shows the location of two and four-year colleges within and adjacent to the sub-region.

The level of educational attainment in Sub-region C is below the State and national averages of median school years completed. Only the city of Clifton Forge compares favorably with these averages. A comparison of educational attainment between Sub-region C and the nation is shown in Figure 5-9.

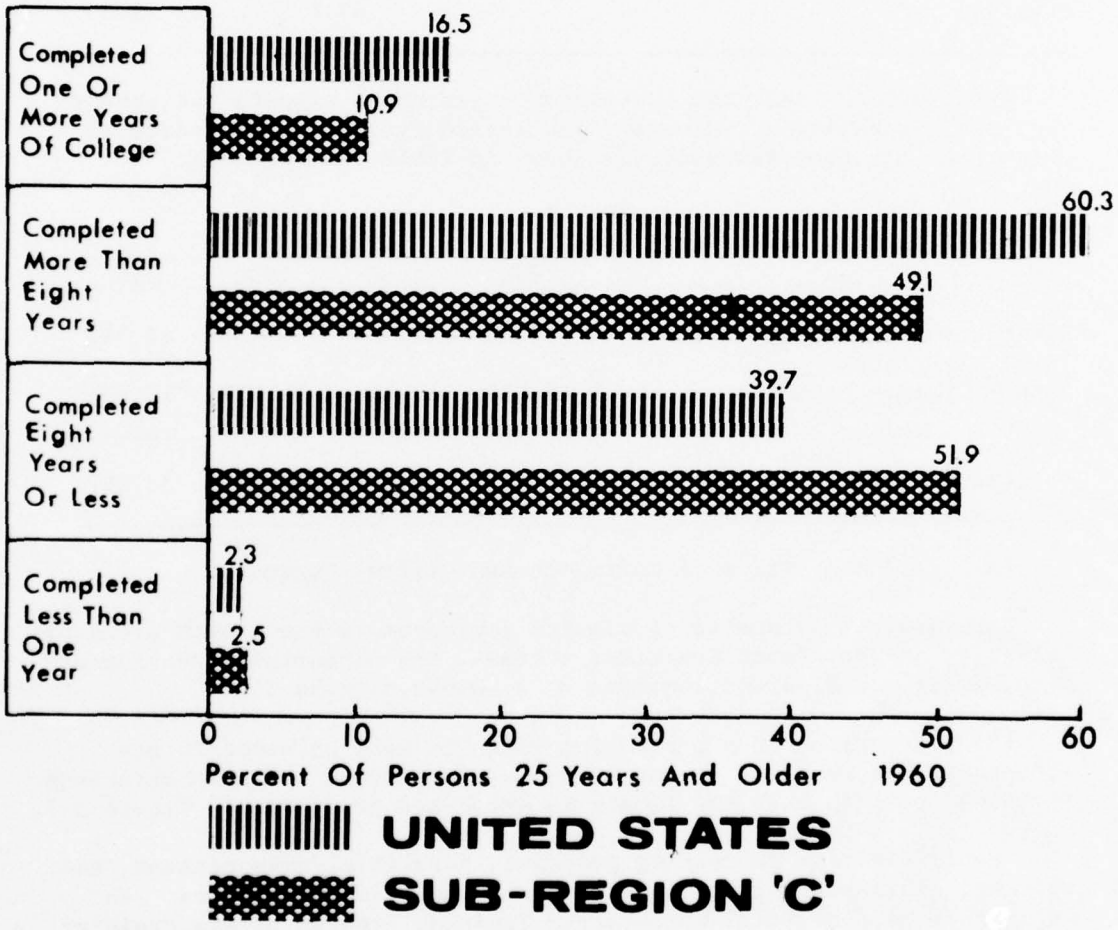


Figure 5-9 Educational Attainment in Water Sub-region C Compared to the United States, 1960.

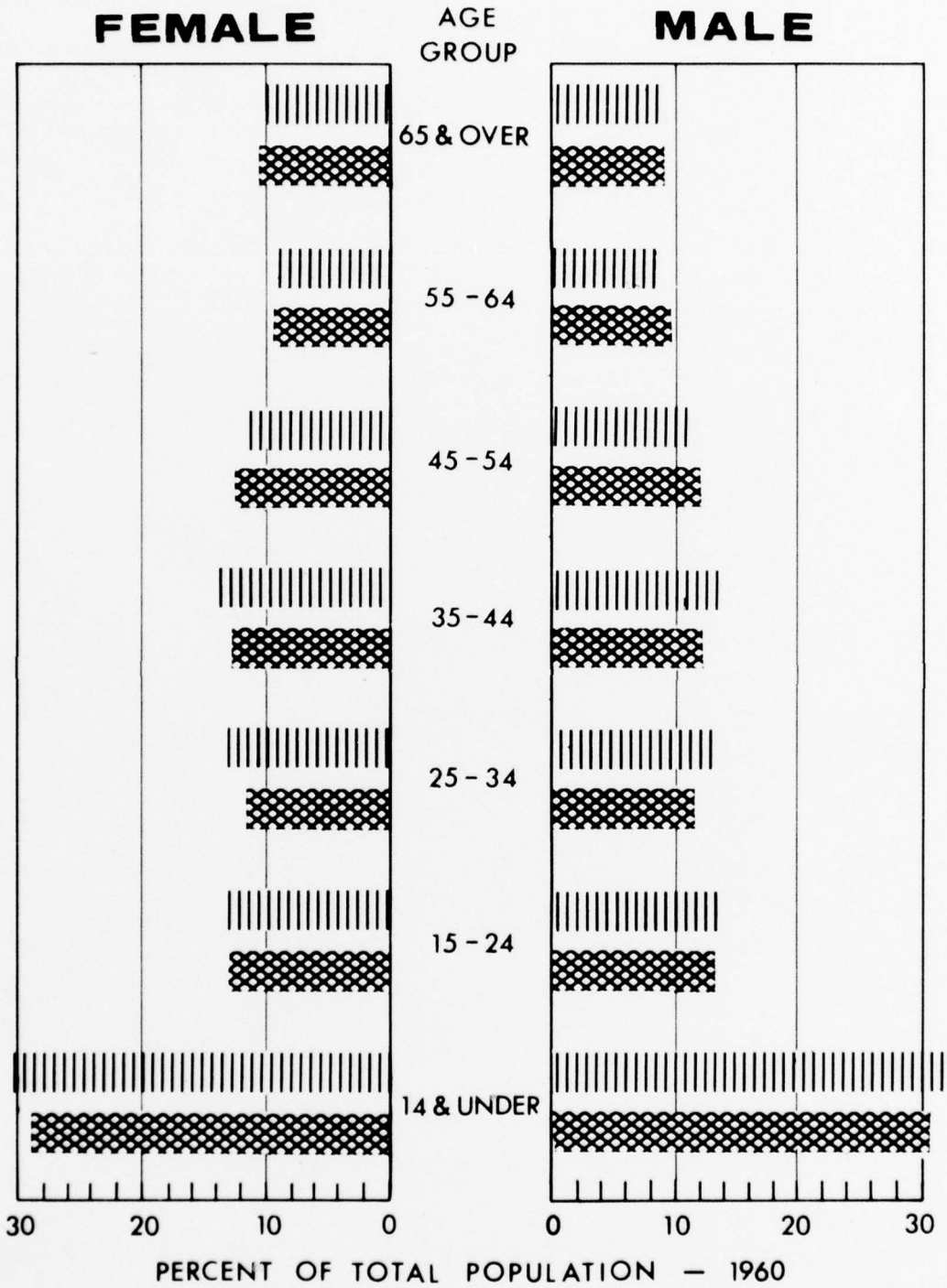
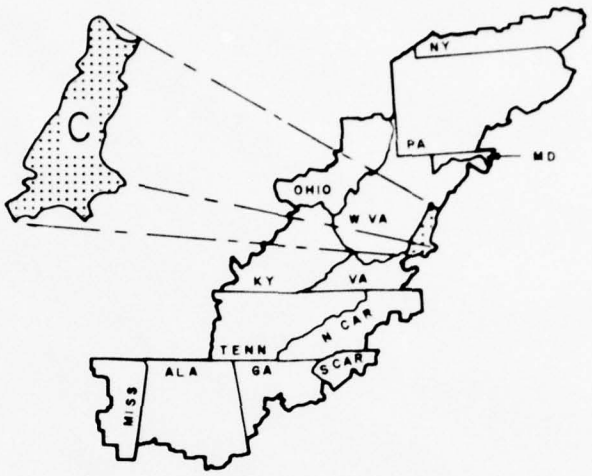

FEMALE
AGE GROUP
MALE
65 & OVER
55 - 64
45 - 54
35 - 44
25 - 34
15 - 24
14 & UNDER
30
20
10
0
0
10
20
30
PERCENT OF TOTAL POPULATION — 1960
UNITED STATES
SUB-REGION 'C'

FIGURE 5-7

PRECEDING PAGE BLANK-NOT FILMED



VICINITY MAP

▲ TECHICNAL OR VOCATIONAL SCHOOLS

■ SENIOR OR JUNIOR COLLEGES

NOTE: FIGURES ADJACENT TO SYMBOLS REPRESENT ENROLLMENT

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION C

HIGHER EDUCATION FACILITIES

20 30 40 50

ALE IN MILES

OFFICE OF APPALACHIAN STUDIES JUNE 1968
11-5-23 FIGURE 5-8

Minerals

The mineral resources are diverse and have supported many industries throughout the area. It is reported that approximately 10 million tons of iron ore were mined in the area during the period 1832 to 1925. However, as the result of the development of the Mesabi Range in the Great Lakes region and discovery of large, high-grade ore deposits elsewhere, no active mining has taken place in this area since 1925. The iron ores presently represent a small reserve of rather low-grade ore that is too inferior in grade to economically justify underground work required to extract it. Investigations by the U.S. Bureau of Mines indicate a potential of about 3 million tons of this ore in Alleghany County.

Commercially important deposits of limestone and dolomite occur from which fluxing stone, manufactured lime, ballast, agricultural lime, and other products are produced. Manganese, shale, silica, clay and quartzite are also found in the area and are potentially suitable as raw materials for the manufacture of brick, tile, pottery, lightweight aggregate and silica sand. Sand and gravel resources in this sub-region are limited, but they are sufficient to serve local needs. There are, however, large deposits of sandstone suitable for crushing. The outlook for sand production is good, if recent production trends are indicative of the future. More sand will likely be shipped for industrial uses, which are expected to grow with diversification of the economy in this and neighboring regions.

Approximately three-fourths of the value of mineral production results from minerals and products shipped out of the sub-region, principally to the east and south. The sub-region is too small an economic unit to exert any great effect upon the growth of its mineral industry. Its future is dependent mainly on the growth of the construction industry within the marketing area, most of which is outside the Appalachian Region. Appendix I, written by the Bureau of Mines, gives further information on this subject.

Lands

The total land area of the sub-region is about 1.47 million acres, of which all but 10,100 acres are presently in agricultural use. The present use of agriculture and forest land is as follows: cropland - 92,300; pasture - 172,500; state and private forest and woodland - 635,000; National Forest land - 537,700; and other land - 17,800 acres. Water areas in the sub-region amount to 3,800 acres or about 0.3 percent of the total land area.

The Federal Government is the major landowner in the sub-region, with about one-third of the sub-region lying in the George Washington and Jefferson National Forests. Another principal Federal land ownership is the portion of Blue Ridge Parkway in Botetourt County consisting of 1,300 acres. The State of Virginia also has major land holdings in the sub-region. The Virginia Commission of Game and Inland Fisheries controls

18,500 acres of land in Alleghany and Bath Counties and has established the Gathright Wildlife Management Area. It has also established the 17,600 acre Highland County Wildlife Management Area. The Virginia Department of Conservation and Economic Development, Division of Parks, administers Douthat State Park with an area of 4,500 acres. The extent and location of public land holdings are shown in Figure 5-10.

About 300,000 acres of forest land is in private ownership, and provides the major source of raw materials for local lumbering, wood pulping, and paper manufacturing industries. The Federal-administered forest lands are managed under the principles of multiple-use and sustained yield for timber, recreation, water, range, and fish and wildlife.

The total land in farms in the sub-region is 456,000 acres, representing about 31 percent of Sub-region C. For the most part, this land is unsuitable for cultivation and is used mainly for pasture, forest and woodland, and wildlife. The following tabulation shows the amounts of these lands suitable for restrictive purposes.

SOIL CAPABILITY

Land area, %	Soils Suitability
1	Deep, well-drained, highly productive for all farm crops.
9	Few limitations for agricultural use. Requires simple conservation practices.
17	Severe limitations for agricultural use and requires careful management and special conservation practices.
12	Very severe limitations, generally restricts their use to pasture, forest and woodland, and wildlife.
61	Unsuitable for cultivation. Use restricted to grazing, forest and woodland, or wildlife.

Total acreage and numbers of farms are declining in the sub-region, while the average farm size is increasing. This is illustrated by the graphs shown in Figure 5-11, based on U.S. Census of Agriculture data. These changes are the result of higher yeilds and more efficient farming

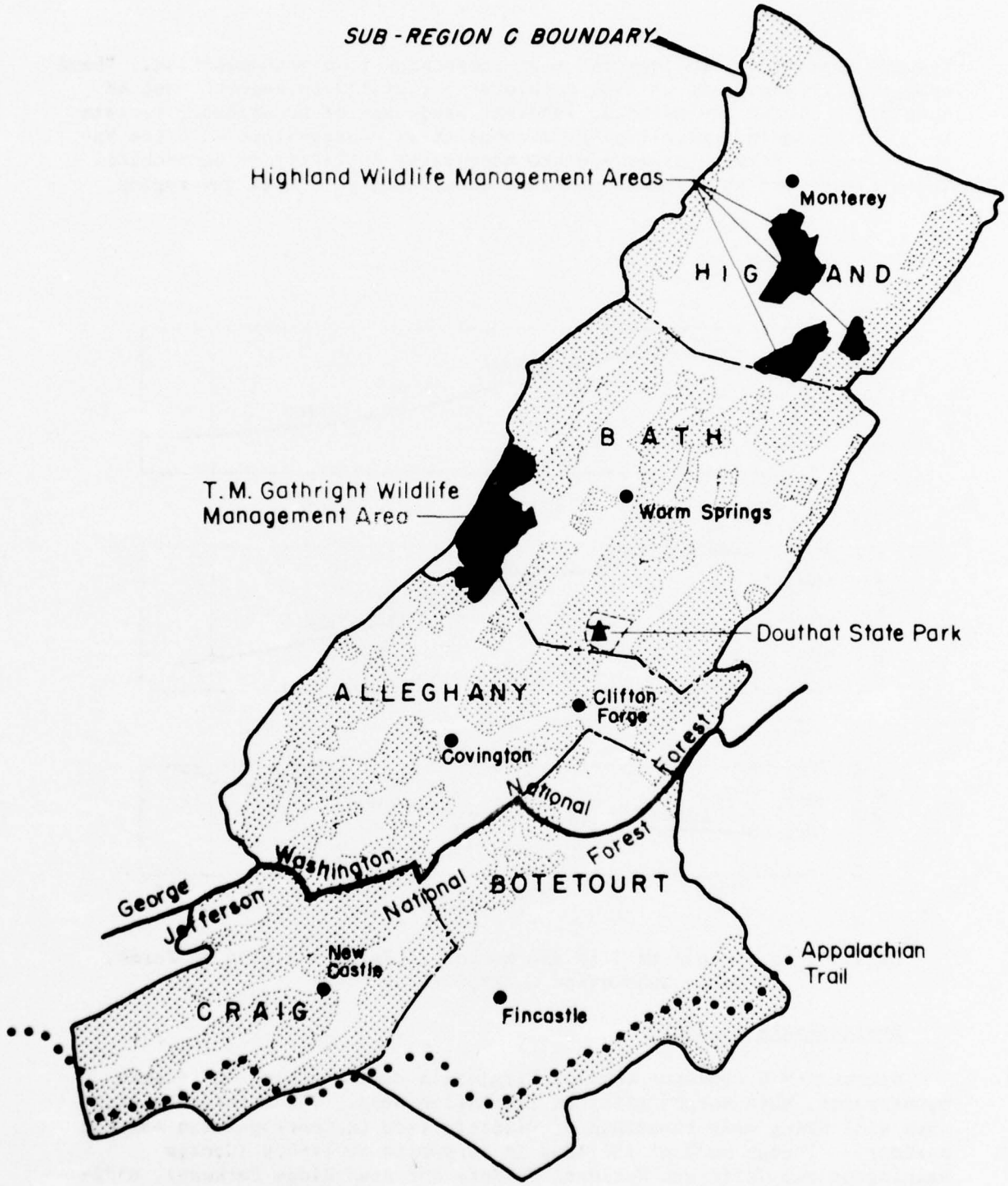


FIGURE 5-10 PUBLIC LAND HOLDINGS

through improved technology and ever-increasing farm mechanization. These adjustments have occurred with accelerated rapidity throughout most of Appalachia, where the natural, inherent handicaps of mountainous terrain keep the Region's agriculture at a comparative disadvantage with the Nation's better farming areas - where topography is little or no problem. These trends are expected to continue indefinitely in this sub-region.

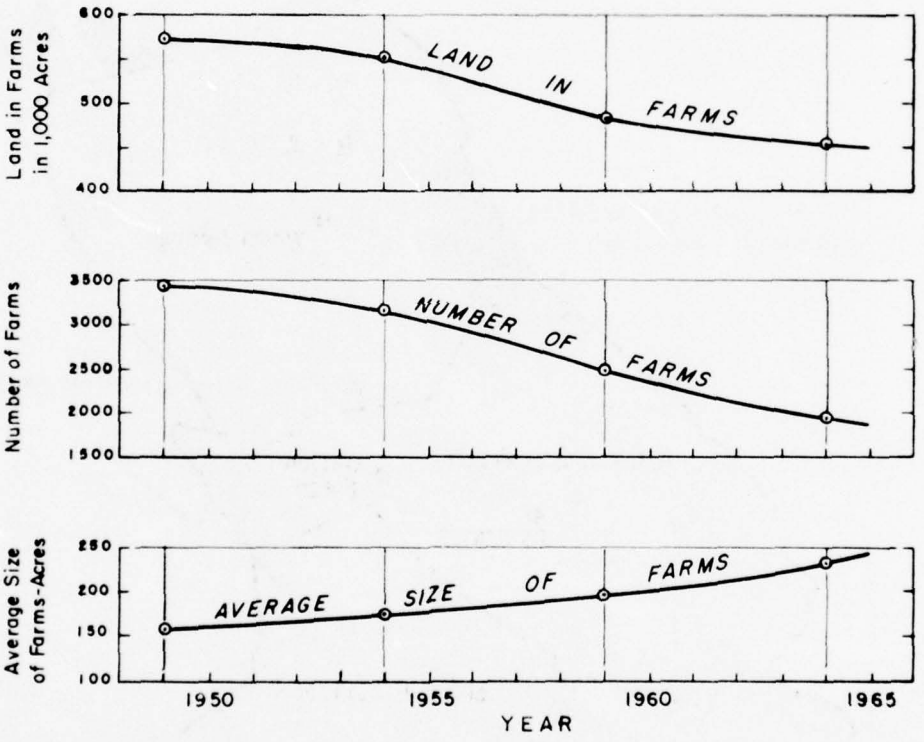
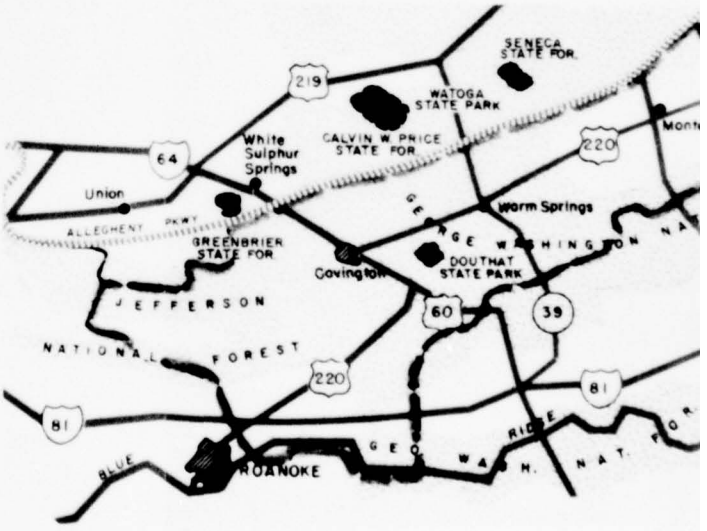


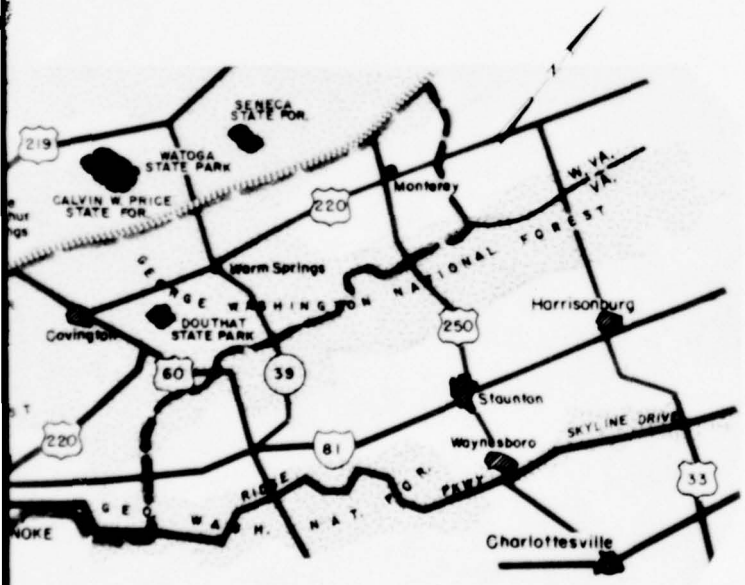
Figure 5-11 Trends in Size and Number of Farms and Land in Farms, Water Sub-region C, 1950-1965.

Environmental Aspects

Sub-region C contains some of Virginia's most charming and scenic countryside, much sought after as recreation area. The interstate highways will bring many thousands of visitors from the metropolitan eastern seaboard. Though much of the land is in public ownership (George Washington and Jefferson National Forests and Blue Ridge Parkway), additional water-based recreation opportunities are necessary to meet the growing population and increasing flow of visitors.



Location of recreation opport
available in and adjacent
sub. region c



of RECREATION OPPORTUNITIES
lABLE IN AND ADJACENT TO
SUB. REGION C

Sub-region C presents some of the most rugged, undeveloped country in the eastern United States. Much of the area contains small, clear, clean mountain streams, beautiful forested hills, high craggy cliffs, weathered rocks, and many other natural features of exceptional scenic beauty. The seasonal vegetative changes associated with rhododendrons, hardwoods, evergreens, and a large variety of shrubs and wildflowers in the mountains add much to the charm of the area.

Existing recreational facilities are centered in George Washington National Forest, Jefferson National Forest, Highland and Gathright Wildlife Management Areas, Douthat State Park, and Blue Ridge Parkway. Figure 5-12 shows the location of these areas and illustrates the recreation opportunities available.

Both fishing and hunting are permitted in George Washington and Jefferson National Forests and in the Highland and Gathright Wildlife Management Areas. Deer, bear, wild turkey, grouse, quail, rabbit, squirrel, and racoon are present in these areas. Mountain streams, many of which have been stocked with brook and rainbow trout, are a fisherman's paradise. Douthat Lake, Jackson River, and the larger streams yield bream, pickerel, bass, and crappie. Both Jefferson National Forest and George Washington National Forest afford many opportunities for camping, hiking, picnicking, and hunting.

Douthat State Park, in Bath and Alleghany Counties just north of Clifton Forge, is one of the most beautiful parks in the State. The park includes overnight cabins, guest lodges, camping areas, a restaurant, picnic grounds and facilities, and a lake for swimming, boating, and fishing. Horseback riding and other sports may also be enjoyed.

The Blue Ridge Parkway, a famous scenic drive, runs along the mountain crest which forms the southeast boundary of Botetourt County. Many summer camps and homes are present along Craig Creek in the northwestern part of the county where vacationers enjoy good fishing and swimming in the clean, scenic waters.

At Gathright Reservoir suitable access to the water and recreation facilities will be provided. The Gathright Project will provide an excellent and much needed facility for water-based recreation. There are no other major reservoir projects in Sub-region C or within a 50-mile radius of Gathright. Three existing Corps of Engineers' reservoirs, Bluestone, Sutton, and Summerville are located in West Virginia just outside the 50-mile radius. Two new reservoirs, Smith Mountain and Leesville, have recently been completed by the Appalachian Power Company on the Roanoke River outside of Sub-region C.

Water Resources Development - Federal

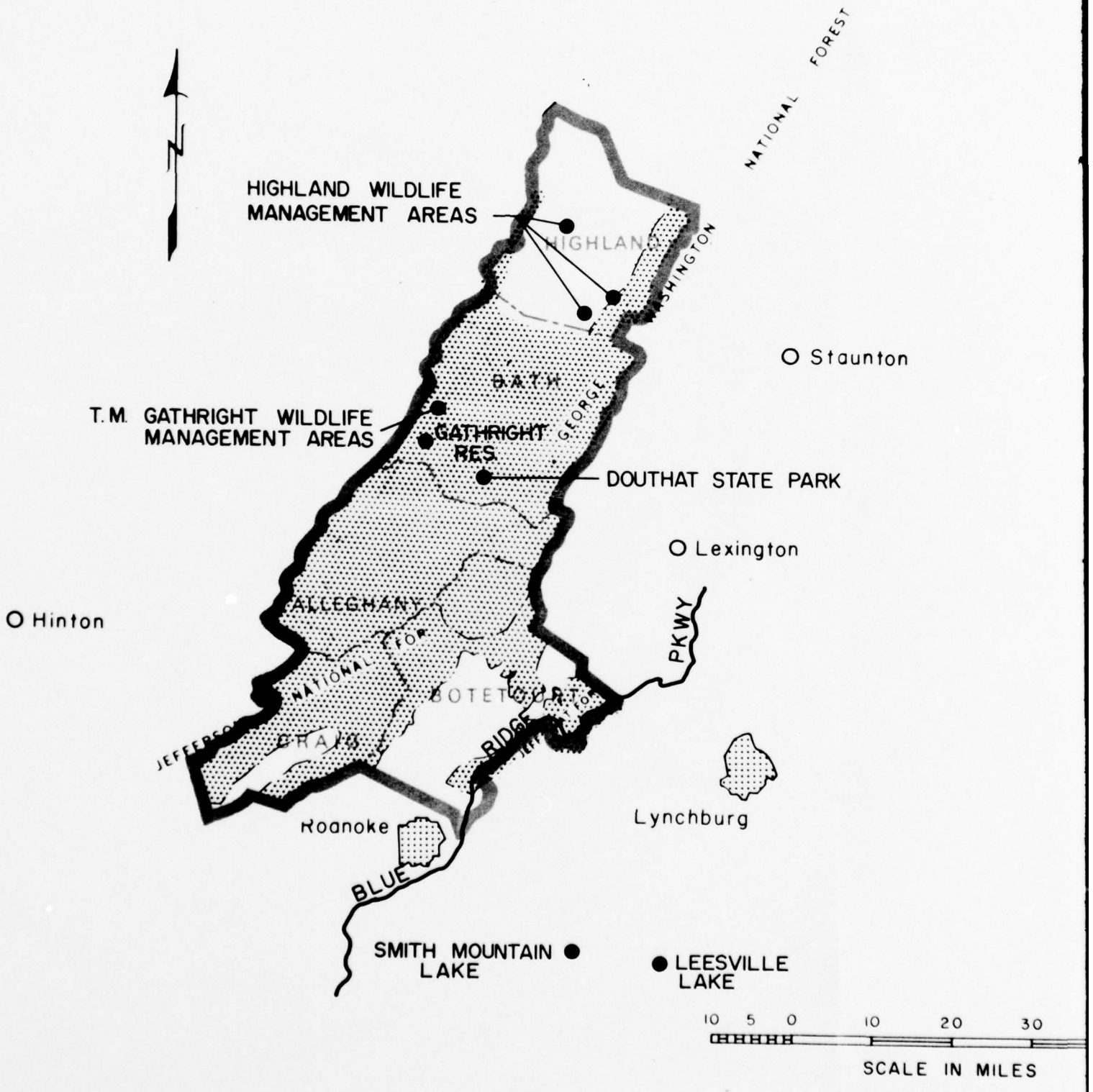
Corps of Engineers

Reservoir Projects. The U.S. Army Corps of Engineers, Norfolk District, is presently constructing Gathright Dam and Reservoir. This project is the only major federal authorized reservoir in the sub-region. The Gathright damsite is located on the Jackson River about 19 miles upstream from Covington. (See Figure 5-13.) The project, scheduled to become operational in 1973, is designed to provide for flood control, water quality control and recreational development. Pertinent design data is presented in Table 5-8.

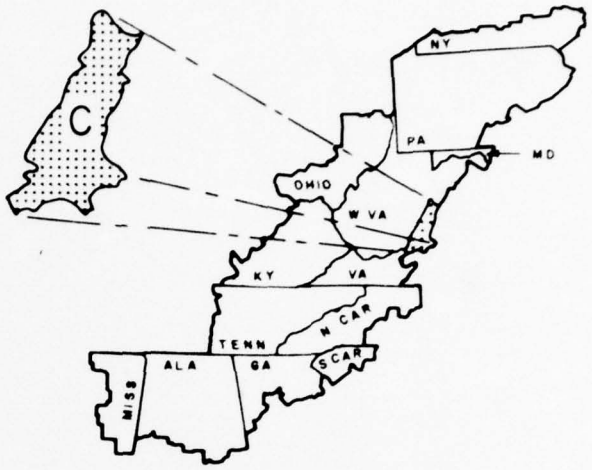
TABLE 5-8
PERTINENT DATA
GATHRIGHT DAM AND RESERVOIR

Item	
LOCATION	
Stream	Jackson River
River Mile	43.4
County	Alleghany, Bath
State	Virginia
STATUS	
Present Purpose	WQ - Rec - FC
Completion Date	1973
DRAINAGE AREA ABOVE (sq. mile)	344
ELEVATION	
Top of Flood Control Pool	1610
Top of Conservation Pool	1582
STORAGE ALLOCATED TO (acre-feet)	
Flood Control	79,900
Water Quality	60,700
Sediment and Recreation	63,000
SURFACE AREA (acres)	
Top of Flood Control Pool	3,160
Top of Conservation Pool	2,530

The reservoir is strategically located so as to meet water and related needs of the Alleghany County growth center as well as responding to needs outside the sub-region. The project will provide storage for low flow augmentation for water quality control as a supplement to adequate waste treatment at its source. The reservoir will have the capacity to increase low flows by as much as 200 cubic feet per second.


N
HIGHLAND WILDLIFE MANAGEMENT AREAS
T.M. GATHRIGHT WILDLIFE MANAGEMENT AREAS
GATHRIGHT RES.
DOUTHAT STATE PARK
O Staunton
O Lexington
O Hinton
Roanoke
Lynchburg
SMITH MOUNTAIN LAKE
LEESVILLE LAKE
BLUE
PKWY
NATIONAL FOREST
BATH
ALLEGHANY
CRAIG
10 5 0 10 20 30
SCALE IN MILES

NATIONAL FOREST



VICINITY MAP

O Staunton

TATE PARK

xington

rg

VILLE
E

5 0 10 20 30 40 50

SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

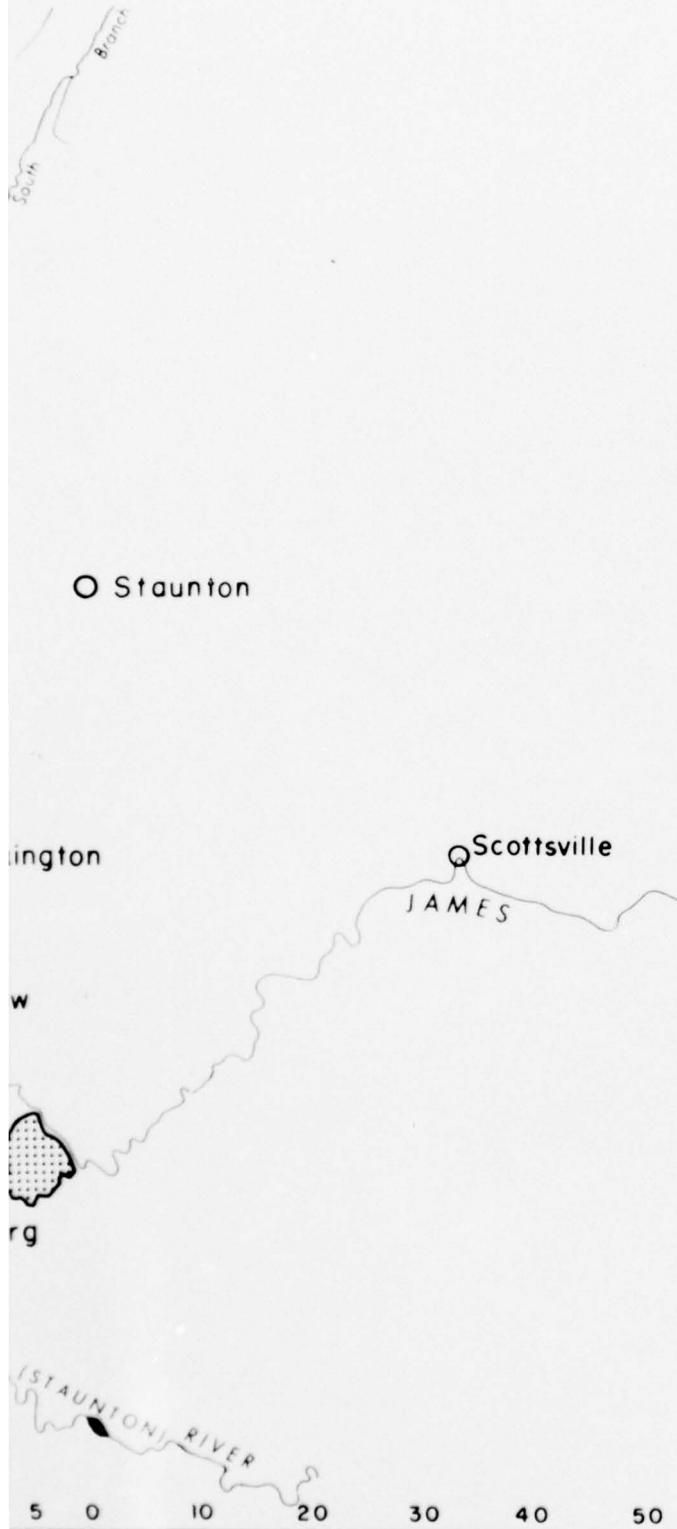
WATER SUB - REGION C

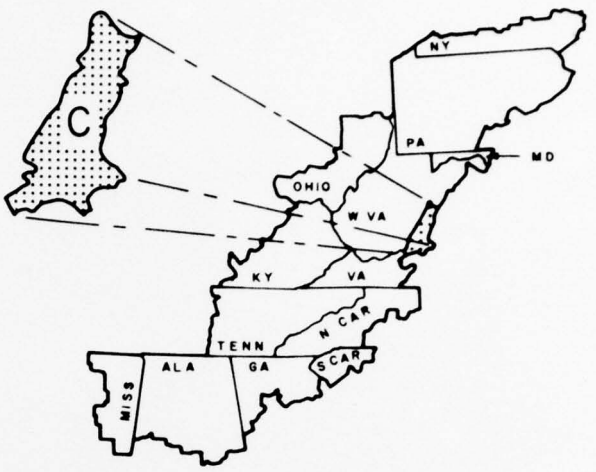
SCENIC AND HISTORICAL SITES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-5-31 FIGURE 5-12

Potomac R
South Fork
S Br
S Fk
Staunton
Lexington
Hinton
Glasgow
Lynchburg
Salem
Roanoke
Vinton
GATHRIGHT RES (C
DOUTHAT ST PK RES
W VA PULP & PAPER CO RES
JOHNS CREEK (USDA)
CARVIN COVE WATERSHED RESERVOIR
SMITH MOUNTAIN LAKE
LEESVILLE LAKE
ROANOKE (STAUNTON) RIVER
JAMES
Jackson
Dunlap
Craig Creek
Sinking
Mowry
10 5 0 10 20 30
SCALE IN MILES





VICINITY MAP

UPSTREAM WATERSHED

EXPECTED TO BE COMPLETED BY 1980

MAJOR RESERVOIR

EXPECTED TO BE COMPLETED BY 1980

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION C

WATER RESOURCES DEVELOPMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-5-33 FIGURE 5-13

2

Augmentation of the natural flow will improve the quality of the water along 40 miles of the Jackson River and the entire length of the James River below the limits of Appalachia to Richmond. Increasing minimum flow which has been experienced during summer months by 200 cfs would represent as much as a 260 percent increase in flow at Covington above Dunlap Creek; a 40 percent increase in flow at Lynchburg, Virginia; and a 30 percent increase in flow at Richmond. Flood damages on an average annual basis will be reduced about 95 percent at Covington and about 60 percent in other urban areas such as Clifton Forge, Eagle Rock and Buchanan. Significant flood damage reduction will be accomplished below the limits of Appalachia ranging from nearly 35 percent at the large industrial center at Lynchburg; 20 percent as far downstream as Scottsville; and to a lesser extent at Richmond. The 2,530 acre lake with its conservation pool at elevation 1582 and the associate shore areas being planned for development will provide a recreational area for such public activities as camping, picnicking, hiking, nature study, and the water oriented sports of fishing, swimming, boating and water skiing. The cold oxygenated water released from the project will provide an environment suitable for trout downstream from the project.

Although this project is already under construction, it played an important role in shaping the water resource plan for Sub-region C. The beneficial effects of Gathright as well as its influence on the formulation of the overall water plan is discussed throughout the next chapter.

Studies Underway. Within Water Sub-region C, there are three major federal water resource studies underway. In addition to the North Atlantic Regional Water Resources and the Northeastern United States Water Supply Framework Studies, the Corps of Engineers, Norfolk District office is also conducting a study of the James River Basin.

U.S. Department of Agriculture

Watershed Projects. The U.S. Department of Agriculture has installed four reservoir structures on the John Creek Watershed in Craig County. (See Figure 5-13.) The impoundments, controlling 31 square miles of drainage area, would provide 4,646 acre-feet of storage for flood prevention. About 18 miles of channel improvement would also be provided. Structural installation costs are estimated to be $551,900 and land treatment measures would total 105,000 dollars. Average annual benefits from installation of the project are estimated to be 35,800 dollars.

Land Use Programs. The land use, treatment, and management program of the various U.S. Department of Agriculture agencies are contributing significantly to improve water quality of the sub-region by reduction of erosion and sediment. Basic conservation plans are being put into effect for about 226,800 acres by over 1,123 landowners and operators cooperating with their local soil and water conservation districts. To date, a total of 698,500 acres, or 48 percent of land in

the sub-region, have been adequately treated through the application and installation of conservation practices needed to meet its planned use, improvement, and protection. State and Federal forest fire prevention and suppression programs cover the entire sub-region. Appendix A discusses the U.S. Department of Agriculture programs in detail.

Other Water Resources Programs. As of June 30, 1967, the U.S. Department of Agriculture's Farmers Home Administration has received applications for water and sewer comprehensive planning grants from three counties totaling about 17,500 dollars. In addition, applications have been received for loans and grants for improving, enlarging, or constructing sewer systems, waste treatment plants, or storm drains from three communities. Total estimated costs exceed 377,000 dollars.

Water Resources Development - Non-Federal

State and Local Projects

Reservoirs. Several small reservoirs have been constructed in the sub-region by non-Federal interests. The Commonwealth of Virginia has enhanced recreational facilities in Douthat State Park by creating a 70-acre lake for public use. The city of Roanoke operates a reservoir on Carvin Creek in Botetourt County which was constructed to supplement the water supply needs of that area. A private pulp and paper company has developed a reservoir near the city of Covington to store water needed for its industrial use. The locations of the impoundments are shown on Figure 5-13.

Studies Underway. The Commonwealth of Virginia has an authorized State Program to study each water basin in Virginia. This will include a study of the James River Basin.

Water Supply and Sewage Treatment Facilities

Tables 5-9 and 5-10 present data concerning development of water supply and sewage treatment facilities in and near the two growth centers of Sub-region C. This information was extracted from the Virginia State Supplement.

TABLE 5-9
WATER SUPPLY FACILITIES

Treated Water Supply System	Rated Plant Capacity (mgd)	Average Plant Output (mgd)
Buchanan - Roanoke Growth Area		
Roanoke - Vinton Area	24.0	13.0
Salem	5.0	2.6
Buchanan	0.24	0.20
Troutville	0.20	0.04
Covington - Clifton Forge Growth Area		
Covington	2.5	1.4
Clifton Forge	3.0	1.8

TABLE 5-10
SEWAGE TREATMENT FACILITIES

Treated Sewage System	Type	Rated Plant Capacity (Population)	Connected Population Equivalent
Buchanan - Roanoke Growth Area			
Roanoke - Salem area	Secondary	220,000	150,000
Vinton	Secondary	6,000	-
Buchanan	Primary	1,900	1,350
Covington - Clifton Forge Growth Area			
Covington	Primary	30,000	24,000
Clifton Forge	Primary	10,000	6,500

In addition to those listed in Table 5-9, a number of other small public and privately owned water supply systems have been developed throughout the sub-region. Most of these utilize springs and wells as a source of supply, with daily usage varying from 20,000 to 100,000 gallons. During extreme dry periods, inadequate supplies have been noted in the outlying communities of Monterey, McDowell, Millboro Springs, Mitchelltown, Hot Springs, Healing Springs, and Warm Springs. (See Figure 5-1 for locations.) These, as well as other water supply problems, are discussed further in Chapter Six.

SECTION II - SOCIO-ECONOMIC STRUCTURE

4. INTRODUCTION

Planning Devices

Appalachia has been divided into ten water sub-regions, labeled "A" through "J," with their boundaries established so as to correspond as nearly as possible to physical areas created by drainage basins, and to areas of responsibility of various participating Corps of Engineer Districts, and the Tennessee Valley Authority. In delineating the water sub-region boundaries adjustments were made to accommodate the State planning sub-regions. Figure 5-14 shows the different planning sub-regions located in Water Sub-region C.

The Office of Business Economics, U.S. Department of Commerce, has regionalized Appalachian counties into a series of twenty-seven economic sub-regions focused on major metropolitan centers, utilizing various measures of economic and social homogeneity and interdependence. These nodal regions serve as the basis for the economic analysis and projections for Appalachia. The projections made on the basis of economic sub-regions have been adapted to the ten water sub-regions and to the water areas and on a very limited basis to the 63 State planning sub-regions. (See Appendix E.) Within Water Sub-region C, portions of two OBE economic sub-regions are represented. Economic Area 10 is structured around the trade and employment centers of the cities of Staunton and Winchester. The area includes the Appalachian Counties of Bath and Highland in Sub-region C, and Pendleton and Hardy in Sub-region B-3, and nine non-Appalachian counties. In 1960, Appalachia accounted for 8 percent of the employment and 9 percent of the population of this economic area. Economic Area 14 has as its center the two nearby cities of Lynchburg and Roanoke. The Appalachian Counties of Alleghany, Craig and Botetourt in Sub-region C and Giles, Puluski, Wythe, and Floyd in Sub-region G-5, together with eleven non-Appalachian counties, make up the area. In 1960, 17 percent of the employment and 18 percent of the population in Economic Area 14 were accounted for by the Appalachian Region.

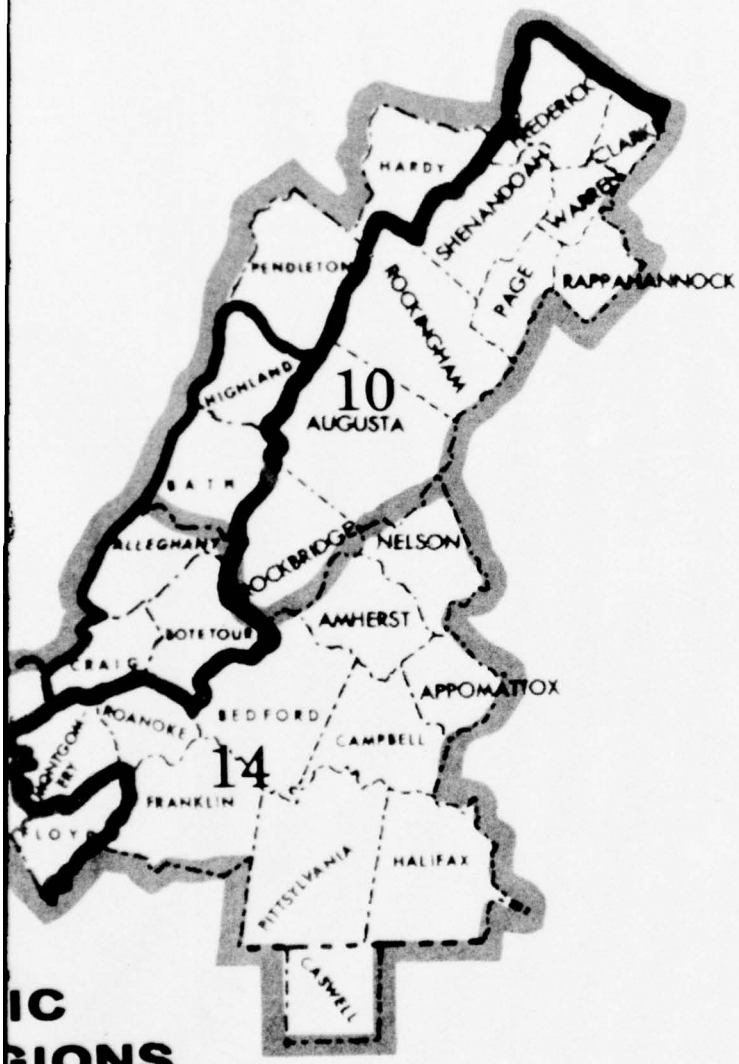
Sixty-three state planning sub-regions, focused on urban growth centers, have been established by the Appalachian States to implement

STATE PLANNING SUB-REGIONS

ECONOMIC SUB-REGIONS

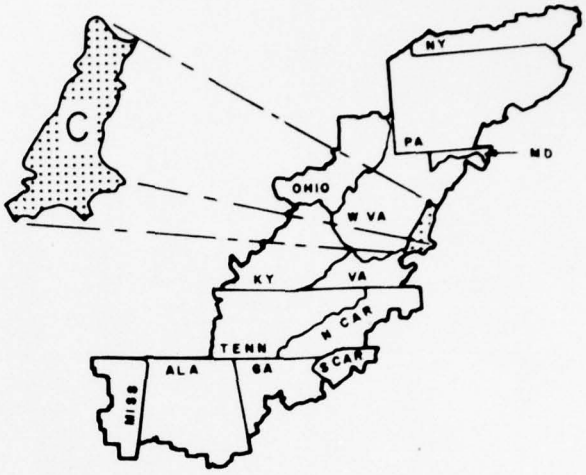
SCALE IN MILES

25 0 25 50



IC
GIONS

SCALE IN MILES
25 0 25 50



VICINITY MAP

APPALACHIAN REGIONAL BOUNDARY

WATER SUB-REGION C BOUNDARY

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION C

PLANNING AREAS

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-5-39 FIGURE 5-14

2

planning and administer programs on the local level. Each state planning sub-region is wholly contained within one state. State Planning Sub-region 28 boundaries, which are coterminous with those of Water Sub-region C, were drawn by the Commonwealth of Virginia to accommodate the strategic and analytical considerations significant in planning and developing their Appalachian area. The Division of Industrial Development was given the responsibility for administration and planning of Virginia's Appalachian program. Through the efforts of this Agency, one development district in the sub-region has been organized and is functioning. Plans are also underway for the establishment of four more districts in the sub-region. Such efforts to pool talents and resources for developmental activities are well established in other parts of the State, and have contributed much to accelerated, orderly growth.

Within each of the state planning sub-regions, the States, as part of their Appalachian Development Plans, have designated one or more areas of significant potential for future growth (growth areas). Such areas have been defined by the Appalachian Regional Commission as follows.

> .....an area consisting of an urban center or centers and their hinterland where the state has determined significant future growth is likely or can be induced.
>
> By a center or centers is meant a complex consisting of one or more communities or places which, taken together, provide or are likely to provide a range of cultural, social, employment, trade, and service functions for itself and its associated rural hinterlands. Though a center may not be fully developed to provide all these functions, it should provide, or potentially provide, some elements of each, and presently provide a sufficient range and magnitude of these functions to be readily identifiable as the logical location for many specialized services to people in the surrounding hinterland.

In general, the Appalachian Regional Commission has been concerned with immediate and near future problems, whereas water resources analysis requires projections of 50 to 100 years in the future. As a result, the best current data available is that prepared by the ARC, and the long-range projections are those prepared by the Office of Business Economics for the Corps of Engineers and the benchmarks prepared therefrom by the Office of Appalachian Studies.

In this chapter ARC data are utilized; the long-range projections follow in Chapter 6.

Growth centers are emphasized in this chapter; however, it should be noted that not all projects for water resources development will be located at these centers. There are some areas, not now recognized as growth centers, which may have developmental potential with a water resource project. Also, some projects serve wide regional interests and thus are not strictly related to local Appalachian growth centers. Examples would be a hydroelectric power project or a major upstream development that would provide flood control, water supply or water quality control for a downstream urban area outside of Appalachia.

The following paragraphs discuss the socio-economic characteristics of the sub-region, and later present a more intimate analysis of the growth areas.

Economic Characteristics

The sub-region experienced two significant shifts in employment between 1940 and 1960: agricultural employment declined more than 50 percent and employment in manufacturing increased nearly 50 percent. Moreover, these changes were occurring while total population was on a downward trend. The out-migration rate during the 1950-1960 period was 14.1 percent. The employment patterns for 1940, 1950 and 1960 are shown in Figure 5-15.

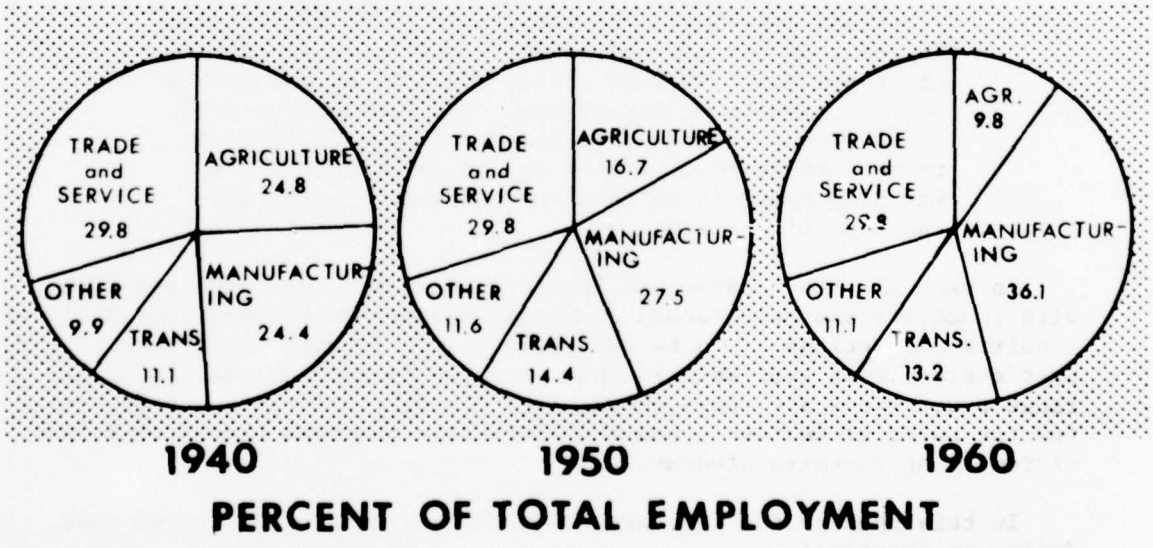
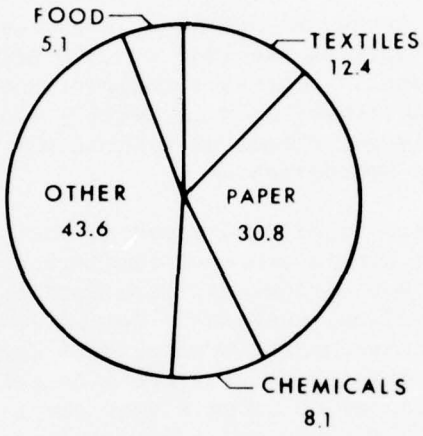


Figure 5-15 Employment by Major Sectors in Water Sub-region C, 1940, 1950 and 1960.

About 36 percent of the sub-region's employment in 1960 was engaged in manufacturing. This compares with 22 percent for Virginia and 25

percent for the nation. Paper-making activities provided the largest source of manufacturing employment in 1960. Textiles and chemicals, although less than in 1950, also shared an important role in manufacturing activities, as shown in Figure 5-16. Manufacturing (1962) accounted for about 42 percent of the wage and salary income in the private non-farm sector.



MANUFACTURING EMPLOYMENT 1960

Figure 5-16 Manufacturing Employment in Water Sub-region C, 1960.

Agricultural employment accounted for about 10 percent of the sub-region's workers in 1960. Agriculture is of substantial economic importance, although, due to the generally rough terrain, it is limited largely to livestock raising. However, crops and forest products make an important contribution to farm income. In 1964, livestock, including dairy and poultry products, accounted for 79 percent of the total farm income. Total value of farm products sold in the five-county area in 1964 was about $7.5 million. Figure 5-17 shows the value of agricultural production for the sub-region in 1949 and 1964.

The pulp and paper industry (largest employer in Sub-region C) is dependent upon the forest lands of the sub-region for its timber supply. In 1962, the sub-region had 838 million cubic feet of merchantable timber; 143 million soft wood, and 695 million cubic feet of hard wood. The annual cut from growing stock in 1962 was 12 million cubic feet or

about 44 percent of the net annual growing stock. The value of timber products output for 1962 was $2,483,000 (see Appendix A for more details).

Employment in mining has declined steadily since 1940 and in 1960 represented only one percent of the total employment of the sub-region. The Bureau of Mines reports that the value of mineral production in 1965 was about 13 million and was mainly the result of cement, stone and clay production in Botetourt County.

Employment in the trade and services industries within the sub-region has remained static in the 1940 to 1960 period with about 29 percent of the employment. This is a reflection of the rural population in the Region. Moreover, many of service and trade requirements are satisfied by the larger cities of Roanoke and Staunton located just outside the sub-region boundaries.

The tourist industry is of importance in the area, and in Bath County, is the largest single employer (employing over 900 persons). Several resort areas, Hot Springs and Warm Springs, are located in Bath County. A large, luxurious, nationally famous resort, White Sulphur Springs, is located in Greenbrier County, West Virginia, adjacent to Sub-region C. Skiing and ice skating are attractions during the winter months. There are a number of large summer camps for boys and girls. In Highland County, maple sugar camps attract thousands in early March during the annual Maple Sugar Festival. In October, numerous camera enthusiasts come to this area to preserve on film the unsurpassed beauty and brilliance of color of the great variety of trees in the mountain ranges. Sportsmen are also attracted by excellent hunting and fishing on private lands and in the George Washington and Jefferson National Forests. During 1966, about 1,027,000 recreational visits were made to the National Forests and an estimated 100,000 to State Forests.

Much of the labor force in the sub-region is employed on a seasonal basis, although statistically they are considered as working year-around. From information presented in the Virginia State Supplement, only Botetourt (4.8 percent) and Craig (4.4 percent) exceeded the national rate of unemployment (3.8 percent) in 1966 (see Figure 5-18). Probably a more accurate indicator of employment problems are reflected by the rates of population change and out-migration. The following tabulation shows the percent of population change experienced by the five counties between 1950 and 1960.

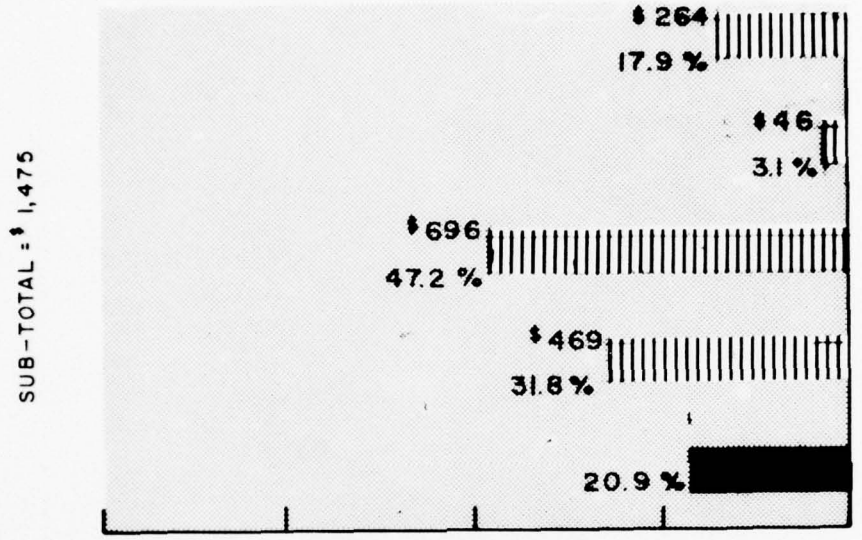
Alleghany	- 1.7%
Bath	-15.3%
Botetourt	+ 6.0%
Craig	- 2.8%
Highland	-20.8%

As noted above, only Botetourt County registered a net in-migration during the 1950-1960 period, while also having the highest rate of

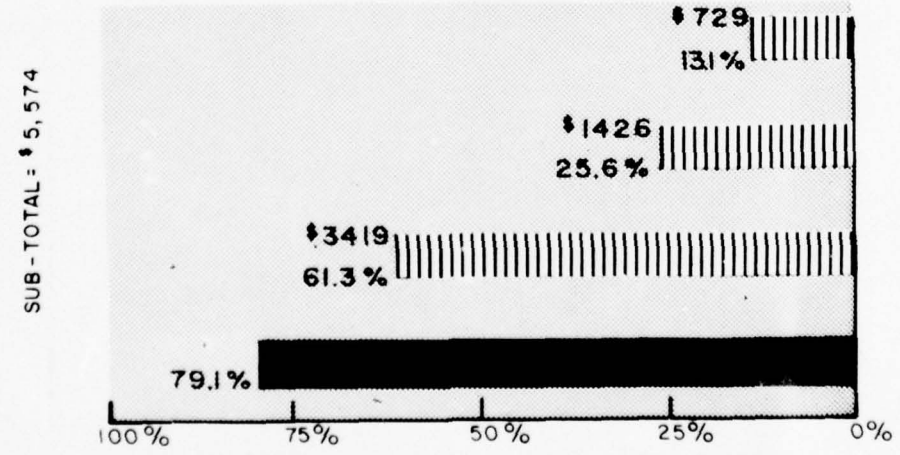
YEAR 1949

CROPS

ITEMS SOLD



LIVESTOCK AND LIVESTOCK PRODUCTS



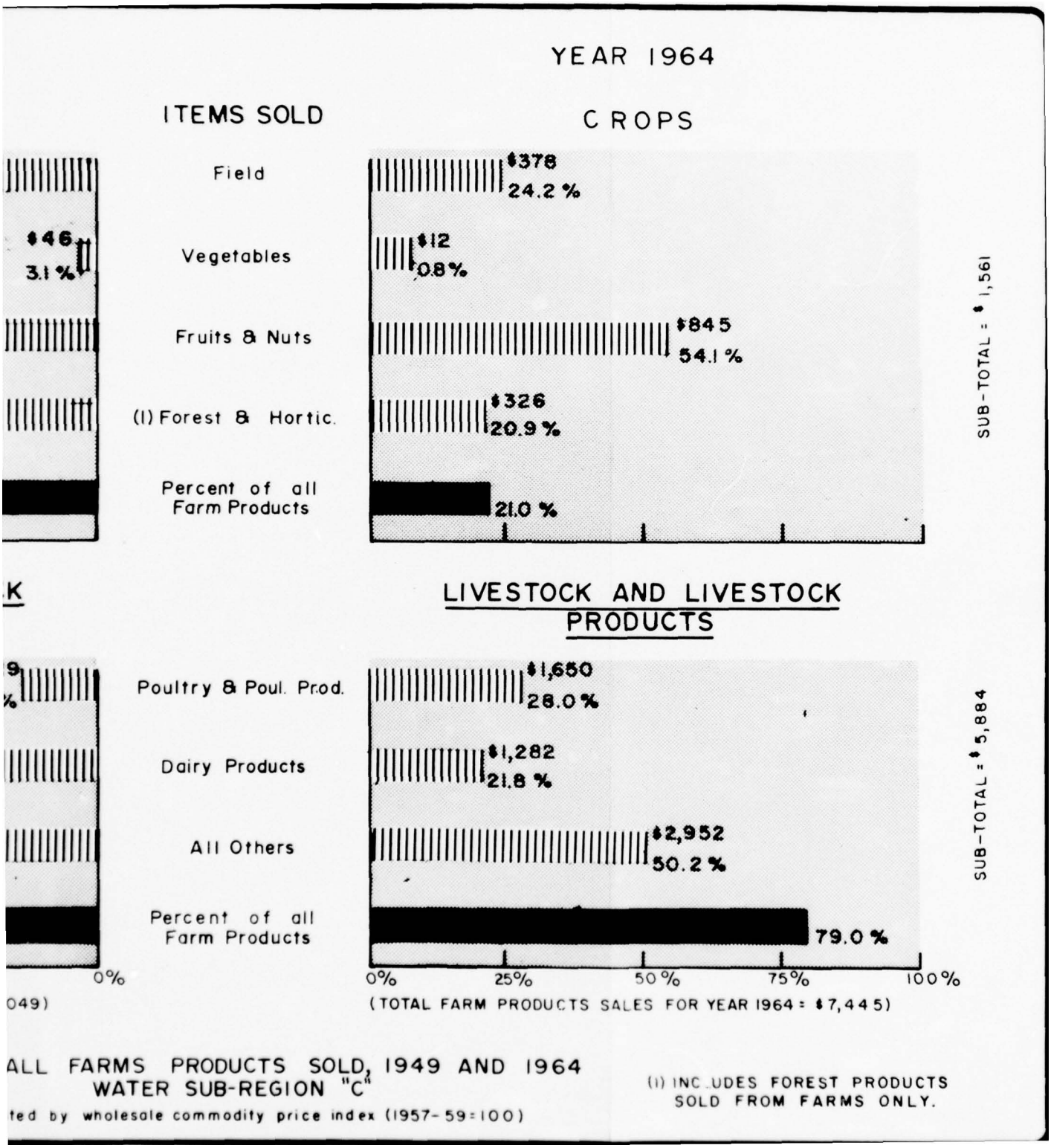
(TOTAL FARM PRODUCTS SALES FOR YEAR 1949 = $7,049)

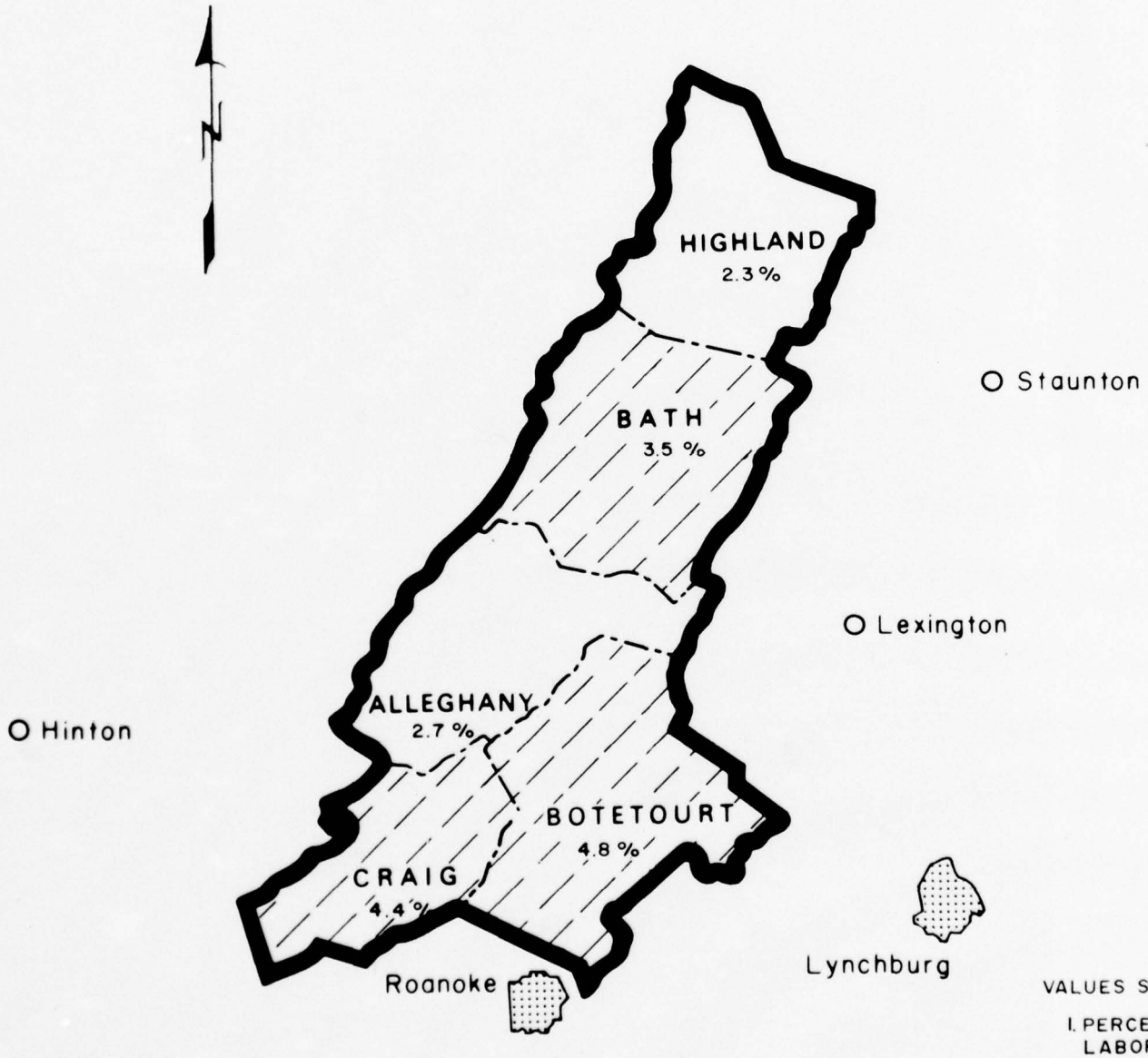
VALUE OF ALL FARMS PRODUCTS SOLD, 1
WATER SUB-REGION "C"

(Adjusted by wholesale commodity price index (

NOTE

FARM PRODUCTS IN THOUSANDS OF DOLLARS
SOURCE - U.S. CENSUS OF AGRICULTURE


YEAR 1964
ITEMS SOLD
CROPS
Field
$378
24.2 %
$46
3.1 %
Vegetables
$12
0.8%
Fruits & Nuts
$845
54.1 %
(1) Forest & Hortic.
$326
20.9 %
Percent of all Farm Products
21.0 %
SUB-TOTAL = $ 1,561
LIVESTOCK AND LIVESTOCK PRODUCTS
Poultry & Poul. Prod.
$1,650
28.0 %
Dairy Products
$1,282
21.8 %
All Others
$2,952
50.2 %
Percent of all Farm Products
79.0 %
SUB-TOTAL = $ 5,884
0%
25%
50%
75%
100%
(TOTAL FARM PRODUCTS SALES FOR YEAR 1964 = $7,445)
ALL FARMS PRODUCTS SOLD, 1949 AND 1964
WATER SUB-REGION "C"
ted by wholesale commodity price index (1957-59=100)
(1) INCLUDES FOREST PRODUCTS SOLD FROM FARMS ONLY.



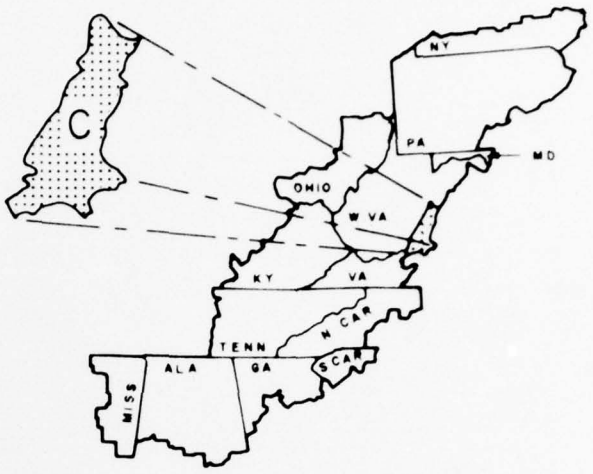
VALUES SHOWN ARE:

1. PERCENTAGE OF CIVILIAN LABOR FORCE FOR 1966

2. TOTAL FOR SUB-REGION C=

10 5 0 10 20 30

SCALE IN MILES



VICINITY MAP

O Staunton

on

COUNTIES HAVING LESS THAN 3.0 %

COUNTIES HAVING 3.0 % – 4.9 %

VALUES SHOWN ARE:

1. PERCENTAGE OF CIVILIAN LABOR FORCE FOR 1966
2. TOTAL FOR SUB-REGION C = 3.2 %

0 10 20 30 40 50

SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION C

UNEMPLOYMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

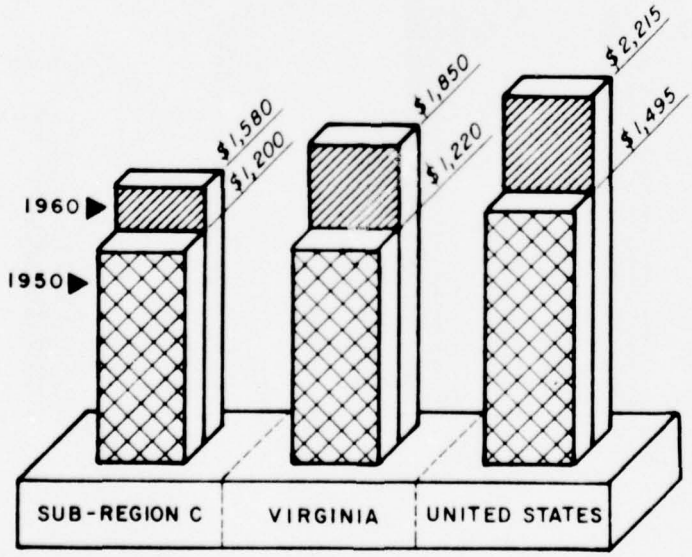
11-5-47

FIGURE 5-18

unemployment. This is the result of bedroom communities being developed in the County with workers commuting to jobs in nearby Roanoke. As reported in the Virginia State Supplement, about 40 percent of those reporting their place of work commuted out of Botetourt County. Job commuting patterns (1960) for the counties of the sub-region are shown below.

	% Commuting Out	% Commuting In
Alleghany	8.6	4.7
Bath	5.8	5.8
Botetourt	40.4	6.2
Craig	32.5	2.8
Highland	10.3	1.4

Generally, family and per capita income in the study area are behind those for the State and the Nation. With the exception of the cities of Covington and Clifton Forge, 1960 per capita income is substantially below the average for the State and the Nation. Per capita income in 1960 ranged from a high of $1,830 in Alleghany County (includes cities of Covington and Clifton Forge), to a low of $1,050 in Highland County. Figure 5-19 shows a comparison of per capita income for the period 1950-1960.



COMPARISON OF PER CAPITA INCOME
(1950-1960)

Figure 5-19 Comparison of Per Capita Income (1950-1960).

On a family income basis, the sub-region was well below the 1959 average of Virginia and the Nation. Thirty-three percent of the families earned less than $3,000 annually, as compared to 28 percent for Virginia and 21 percent for the Nation. A comparison of family income distribution is shown in Figure 5-20. The source of income (earnings) in 1966 by broad sectors is shown for the sub-region, Appalachia and the United States in Figure 5-21. Compared to Appalachia, manufacturing and government are high and mining low in Water Sub-region C. Relative to the United States, manufacturing is considerable higher while the trade and service sectors are somewhat lower.

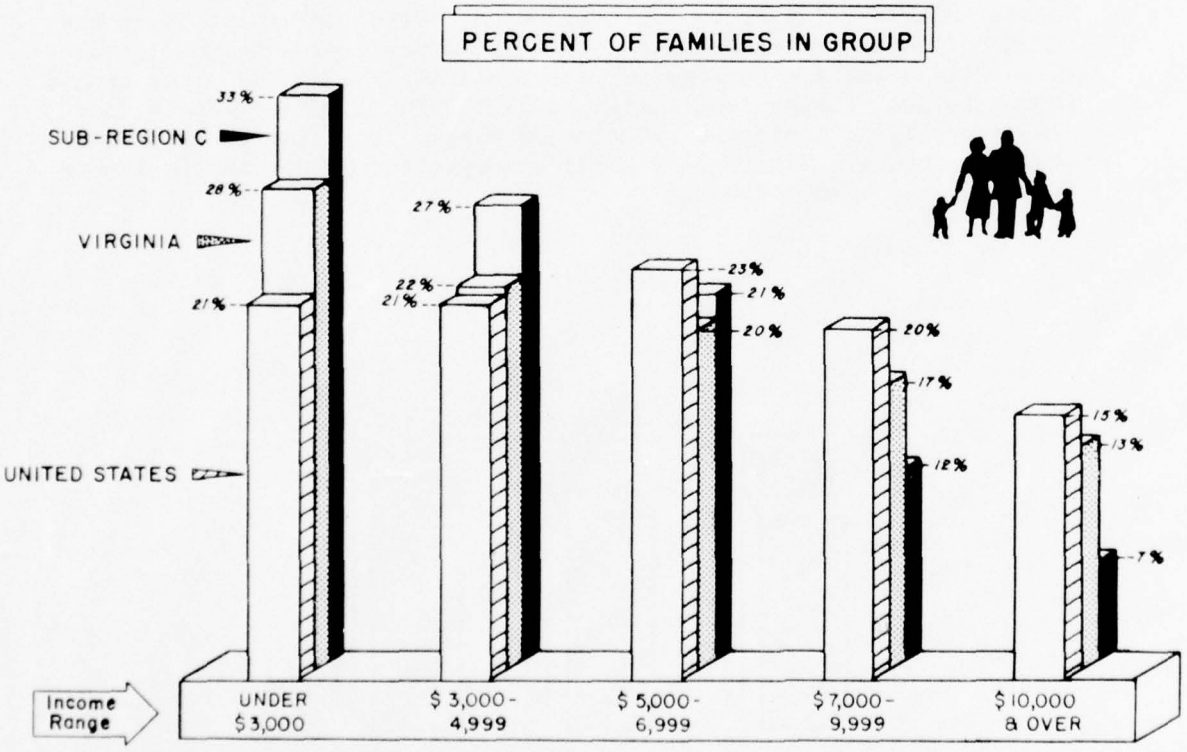


Figure 5-20 Family Income Distribution in Water Sub-region C, 1960.

An analysis of the area indicates that the sub-region as a whole generally has a net import-export deficit. This is due primarily to the lack of a major trading center within the sub-region and the proximity of the

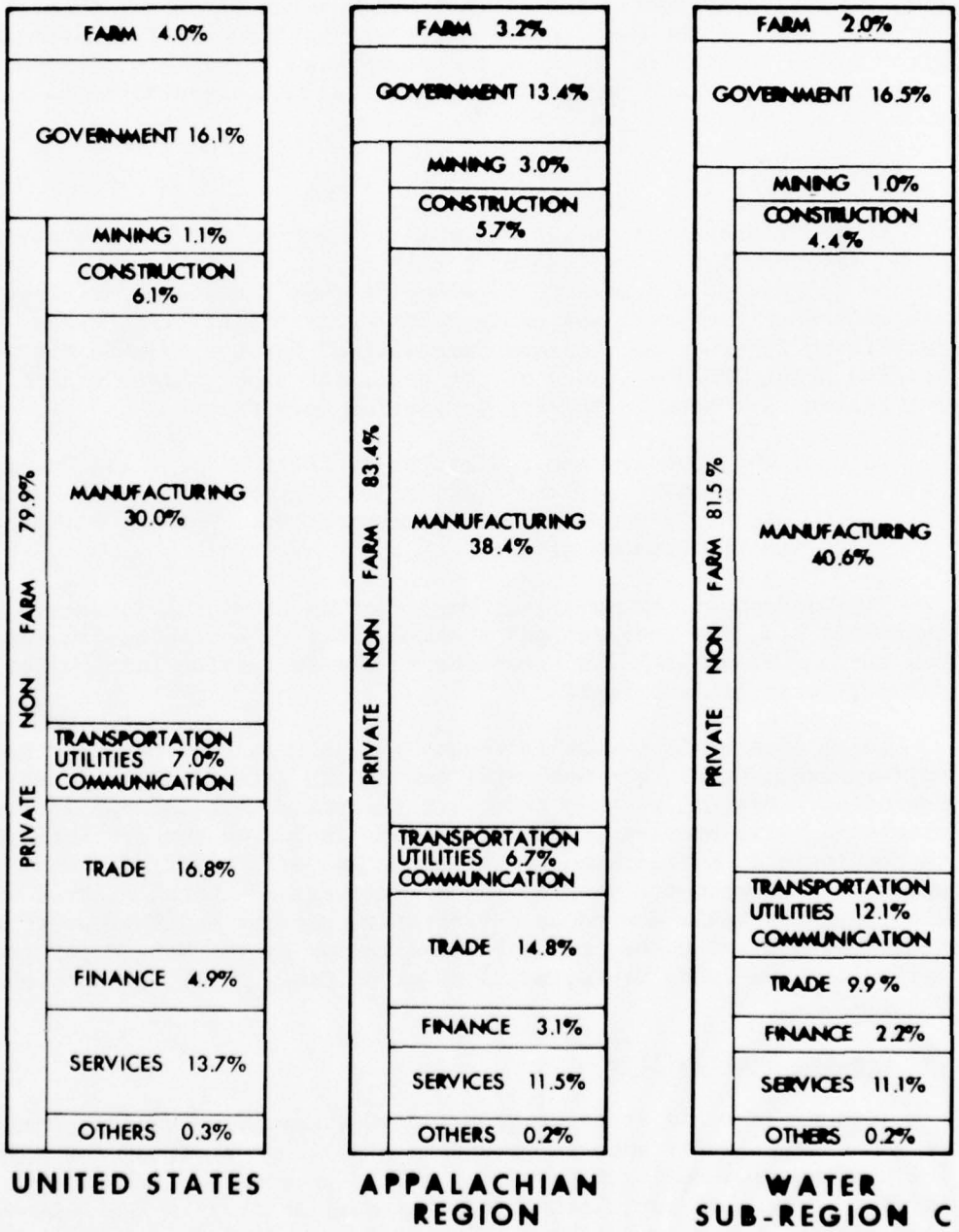


FIGURE 5-21 SOURCES OF INCOME

city of Roanoke. Although considerable manufacturing activity is located in the vicinity of Covington, many of the workers commute from outside the area, principally from adjacent counties in West Virginia; much of the raw material used in the manufacturing process is imported from outside the area; and a substantial part of the wages paid to workers is spent out of the area. Also, much of the income from agriculture activities is spent outside of the sub-region.

Local Attitudes

With the exception of the Alleghany - Clifton Forge - Covington Area, the prevailing attitude of the local leadership is geared more toward recreation and tourist development than industrial development. The growth of Botetourt and Craig Counties is aligned with their increasing function as "bedroom communities" for the Roanoke Metropolitan Area. However, each of the political subdivisions within the sub-region is active in seeking industrial development.

Each of the counties and the cities of Clifton Forge and Covington have planning commissions; and Alleghany - Clifton Forge - Covington, Botetourt, and Craig Counties have entered into a regional planning district with the Roanoke Area.

Within each of the political subdivisions the local interests favorably view the proposed and planned water resource developments and are concerned with the expansion of the recreation and tourist industries in the sub-region.

Local opinion is favorable toward the construction of Hipes Reservoir on Craig Creek, and Gathright Dam on the Jackson River above Covington. Generally, they express the opinion that the project, when completed, will provide needed functions, including the attraction of recreationists and tourists to the area, and will contribute substantially to economic development of the region. Local attitudes have also been favorable toward land treatment programs and the Upstream Watershed Project authorized for installation by the U.S. Department of Agriculture on Johns Creek, a tributary of Craig Creek, in Botetourt County.

Capital Availability

Both Federal and State programs provide some source of capital to the area. Federal assistance in providing a portion or all of the planning and construction costs of justified public improvement projects is authorized under a variety of legislative programs administered by the Departments of Agriculture, Commerce, Defense, Education and Welfare, Housing and Urban Development, and Interior. Usually, local and/or State governments are required to contribute a percentage of the costs of projects partly sponsored under one of the Federal assistance programs.

Of prime importance to economic development throughout the State and the sub-region is legislation passed by the General Assembly of

Virginia in 1966. Under this legislation, local authorities can issue industrial revenue bonds to cover the cost of land, buildings, and equipment for manufacturing, research, and distribution facilities for lease by suitable companies.

The State of Virginia's investment program for the Appalachian portion of Virginia in Fiscal Year 1968 attempts to delineate a program which over a period of years will assist the people of the Region in acquiring the training, skills, and health which are needed to help the Region develop a diversified economy with continually increasing employment and income opportunities. The capstone of this strategy is to (a) make improvements in the State and local educational programs; (b) step up construction of the State's systems of interstate and arterial highways, thereby facilitating the quick and economical movement of people and goods, and (c) take action to conserve and develop the water and other natural resources of the Commonwealth.

Financing requirements of the area are met principally by the fourteen commercial banks located within the five counties. Eight of the commercial banks are charted nationally and the remainder are chartered by the State. Bank deposits per-capita for the counties in the sub-region are shown in Figure 5-22.

Local government revenues are obtained through real estate, machinery and tools, a tangible personal property, merchants capital, and license taxes. Tax rates and assessment ratios vary widely in the area. The average tax rate per $100 in sub-region C is $3.44, as compared to a State average of 3.27 dollars. Assessments rate in Sub-region C averages 26 percent as compared to a State average of 25 percent.

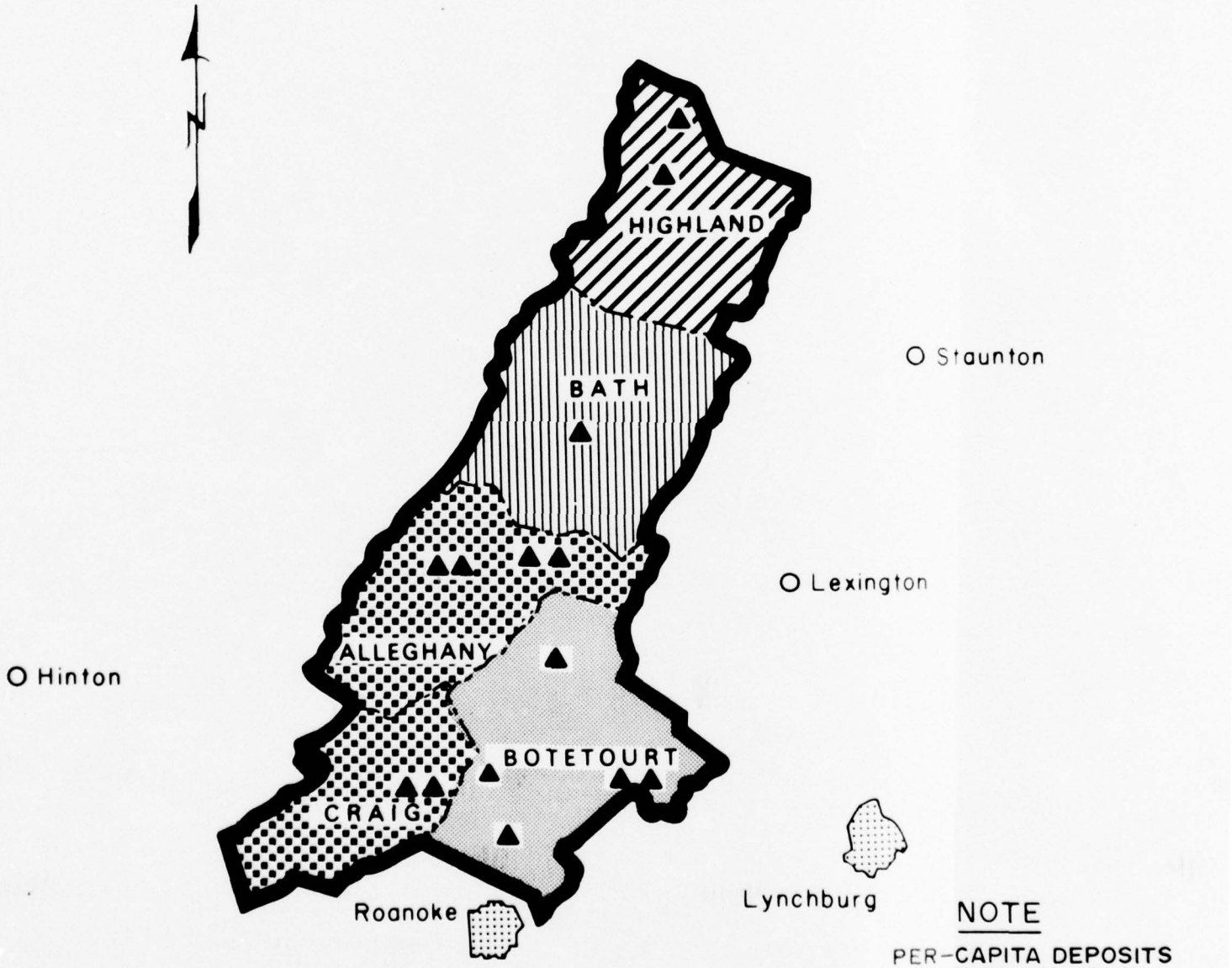
Outside private capital has been invested in the sub-region in recent years. Since 1960, the most significant outside investment has been the location of a synthetic fiber manufacturing plant employing over 1,000 persons in Covington. Also in Covington, large investments have been made in expanding and modernizing facilities at the large pulp and paper mill. Other outside investments in small manufacturing plants have been made since 1960, particularly in Botetourt County. In the period 1960-1966, six small manufacturing plants have located in the sub-region.

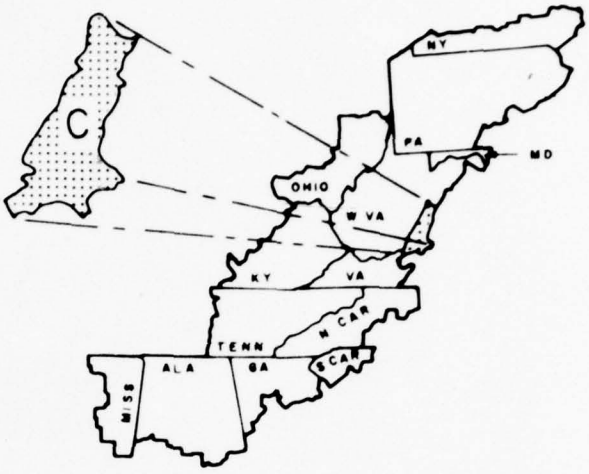
The tabulations in Tables 5-11 and 5-12 present the most recent census data for the sub-region.

TABLE 5-11

EMPLOYMENT BY SECTORS FOR 1950 AND 1960
VIRGINIA STATE PLANNING SUB-REGION 28

	1950	1960	Absolute Change
TOTAL ALL SECTORS	20,272	19,739	- 533
PRIMARY ACTIVITIES	3,758	2,097	- 1,661
Agriculture	3,466	1,821	- 1,645
Forestry & Fisheries	59	77	18
Mining	233	199	- 34
SECONDARY ACTIVITIES	6,766	7,246	470
Contract Construction	1,350	1,165	- 185
Food & Kindred Products	264	334	70
Textile Mill Products	851	833	- 18
Apparel	100	291	191
Lumber, Wood Products, Furniture	840	873	33
Printing & Publishing	89	130	41
Chemicals & Allied Products	861	526	- 335
Electrical & Other Machinery	20	101	81
Motor Vehicles & Equipment	2	0	- 2
Other Transportation Equipt.	9	10	1
Other & Miscellaneous	2,390	2,983	593
TERTIARY ACTIVITIES	9,327	10,030	703
Transportation & Communi-cations	2,600	2,142	- 458
Utilities & Sanitary Service	230	293	63
Wholesale Trade	163	194	31
Retail Trade	2,195	2,381	186
Finance, Ins. & Real Estate	229	289	60
Personal Services	1,945	2,039	94
Professional Services	1,332	1,895	563
Recreational Services	131	103	- 28
Public Administration	490	599	109
Armed Forces	12	95	83
NOT REPORTED	411	366	- 45


N
HIGHLAND
BATH
ALLEGHANY
BOTETOURT
CRAIG
Roanoke
Staunton
Lexington
Lynchburg
Hinton
NOTE
PER-CAPITA DEPOSITS
AS OF 31 DEC. 1967
10 5 0 10 20 30
SCALE IN MILES



VICINITY MAP

O Staunton

ington

LEGEND

▲ SAVINGS & LOAN ASSOCIATIONS

BANK DEPOSITS, PER-CAPITA BY COUNTY:

$600 - $799

$800 - $999

$1000 - $1199

$1200 OR MORE

NOTE

PER-CAPITA DEPOSITS AS OF 31 DEC. 1967

5 0 10 20 30 40 50

SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION C

FINANCIAL SITUATION

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-5-55

FIGURE 5-22

TABLE 5-12

SOCIO-ECONOMIC CHARACTERISTICS
VIRGINIA STATE PLANNING SUB-REGION 28
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	58,679	Number	57,085	28,272	28,813	7,826	32,929	16,330
Absolute Change 1960-1965	1,594	Percent Distribution	100.00	49.53	50.47	13.71	57.68	28.61
Percent Change 1960-1965	2.8	Percent Change 1950-1960	-2.45	-4.34	-0.52	-51.37	7.02	40.11

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	3,093	1,755	5,602	3,207	926	14,583
Percent Distribution	21.21	12.03	38.41	21.99	6.35	100.00
Percent Change 1950-1960	-43.20	-44.64	43.09	561.24	400.54	3.65

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	32,178	15,890	11,971	3,500
Percent Distribution	100.00	49.38	37.20	10.88
Percent Change 1950-1960	1.27	-14.18	37.44	26.13

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	19,644	1,145	14,109	790	5,535	355
Percent Distribution	94.49	5.51	94.70	5.30	93.97	6.03
Percent Change 1950-1960	-3.04	90.83	-11.44	67.73	27.86	24.13

RATE OF UNEMPLOYMENT, 1962-65

1962	6.3
1963	4.2
1964	4.1
1965	3.6

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	20,884	19,924	14,991	4,985	5,893	14,939
Percent Distribution	51.18	48.82	75.05	24.95	28.29	71.71
Percent Change 1950-1960	0.06	15.17	-8.66	6.00	32.16	18.60

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng.1962-65 No.	Chng.1962-65 %
Tot.Work Force	19.6	0.6	3.2
Tot.Employment	18.9	1.1	6.1
Unemployment	0.7	-0.5	-41.7

5. GROWTH AREAS

As in the case of state planning sub-regions, areas, in which growth is anticipated, have been delineated by the states concerned. In Water Sub-region C, two areas were considered to have significant growth potentials. These are Buchanan-Roanoke (partly outside the sub-region), and Covington-Clifton Forge (completely within the sub-region). The areas are described in the following paragraphs, with most of the statistical details extracted from the Virginia State Supplement.

Buchanan-Roanoke Growth Area

This area consists of Botetourt and Roanoke Counties, the independent city of Roanoke, and parts of Bedford, Floyd, Franklin and Montgomery Counties. Its growth center extends from Roanoke and Salem to Buchanan and Eagle Rock along Highway 220 and Interstate Highway 81.

The population of the growth area increased at an average annual rate of 1.5 percent between 1950 and 1960, and is expected to accelerate at a rate of more than 2 percent annually during the 1960's. Much of this growth is anticipated to occur within the Appalachian County of Botetourt.

The Botetourt-Roanoke growth center has a well-established economic base, with diversified manufacturing, trade, and service activities. There are presently 55 manufacturing establishments with 50 or more employees. Total employment in these plants was about 15,000 in 1966. The type of industry and numbers of each within the growth center are listed below.

Industry	Number of Plants
Food Processing	13
Apparel	9
Fabricated Metals	5
Furniture, Stone, Clay, Glass	4 (ea)
Printing and Publishing	3
Electrical, Textile, Transportation Equipment	2 (ea)
Chemicals	1
Leather Products	1
Lumber and Wood Products	1

Seventeen of the above plants located within the growth center between 1960 and 1966, adding about 2,000 jobs; three of these located in Botetourt County. The total value added by manufacturing in 1963 amounted to 139,522,000 dollars. Other important activities (principally in Botetourt County) were mining and agriculture. The 1963 value added in mining was about $4 million, while the value of farm products sold in 1964 was about $7 million.

The rapid development being experienced in the growth center is reflected in the increased personal income of its citizens. The percent increase in income from 1960 to 1965 was 34 in Botetourt County, 59 in Roanoke County, and 14 in Roanoke City.

All of the separate political entities in the growth center are members of the Roanoke Valley Regional Planning Commission. This group has been very progressive in local planning, having assisted in providing the localities with zoning and sub-division ordinances, and in some areas has prepared comprehensive land use and highway transportation plans.

Covington-Clifton Forge Growth Area

This growth area consists of Alleghany County, the independent cities of Clifton Forge and Covington, and a part of Bath County, all within the boundaries of Sub-region C. Its growth center extends from Covington to Clifton Forge along Interstate Highway 64. The growth area's population decreased at an average annual rate of 0.3 percent in the 1950's, but has levelled off in the 1960's and is expected to increase at about 0.6 percent annually from 1965 to 1970.

The area has well-established manufacturing and retail trade bases, but has a need for growth in service establishments. There are ten manufacturing establishments, with 20 or more employees presently located in the Covington-Clifton Forge growth center. In 1960, these plants provided employment for about 5,000 persons. The type of industry and numbers of each within the growth center are listed below.

Industry	Number of Plants
Food Processing	3
Apparel	1
Chemicals	1
Furniture	1
Instruments	1
Paper	1
Printing and Publishing	1
Rubber Products	1

Three of these plants have located in the center since 1960 and in 1966 had an average employment of 2,010 persons. The manufacturing industry has become vitally important to the economy of the growth area, and provided for 41 percent of the 1966 employment. This compares with 13 percent in trade, 8 percent in the service industries, and only 1 percent in Agriculture.

The shift to a predominant manufacturing base is reflected in the increased personal income in the growth area. Alleghany County had a

forty-eight percent increase in total personal income between 1960 and 1965, while the cities of Clifton Forge and Covington had increases of 38 and 12 percent, respectively.

The three political entities in the growth center (Alleghany County, Clifton Forge City, and Covington City) are members of a regional planning commission. All three have established sub-division ordinances, and Covington has adopted zoning ordinances and has also prepared a land-use plan.

DEVELOPMENT
OF
WATER RESOURCES
IN
APPALACHIA

MAIN REPORT
PART II
SHAPING A PLAN

CHAPTER 6 - SHAPING THE PLAN FOR SUB-REGION C

TABLE OF CONTENTS

Par.	Subject	Page II-6-
	SECTION I - FUTURE GROWTH PATTERN	
1	WATER SUB-REGION	1
2	DEVELOPMENTAL CONSTRAINTS	2
3	PATTERN OF GROWTH ANTICIPATED	3
	SECTION II - WATER RELATED NEEDS	
4	INTRODUCTION	5
5	PROBLEMS IN GENERAL	5
	Flood Control	7
	Land Development and Management	10
	Water Supply	13
	Irrigation	15
	Maintenance of Stream Quality	15
	Navigation	19
	Power	20
	Recreation	20
	Other	20
	Needs Outside the James River Basin	22
	Summary	23
	SECTION III - ALTERNATIVES FOR MEETING NEEDS	
6	INTRODUCTION	25
7	STRUCTURAL	25
8	NON-STRUCTURAL	27

CHAPTER 6- SHAPING THE PLAN FOR SUB-REGION C

TABLE OF CONTENTS
(cont'd)

Par.	Subject	Page II-6-
	SECTION IV - EVOLUTION OF THE SUB-REGION WATER RESOURCES DEVELOPMENT PLAN	
9	SELECTION OF BEST INDIVIDUAL SOLUTIONS	29
	Structural	29
	Land Treatment Measures	39
	Development of Recreation Facilities	40
	Flood Plain Management	42
	Future Studies	42
10	ADJUSTMENT OF PLAN	42
11	RESULTING PLAN	43
12	EFFECTIVENESS OF THE PLAN	43
	SECTION V - PLAN ELEMENTS DESCRIPTION	
13	THE PLAN	49
	Gathright	49
	Hipes	49
	Upstream Watershed Projects	50
	Accelerated Land Treatment Measures	51
	National Forest Recreation Development	52
	Flood Plain Management	52

CHAPTER 6 - SHAPING THE PLAN FOR SUB-REGION C

LIST OF TABLES

Table No.	Title	Page II-6-
6-1	Average Annual Flood Damages Along James River and Major Tributaries Upstream From Lynchburg With Gathright Project in Operation	9
6-2	Average Annual Damages in Upstream Watersheds	10
6-3	Potential Industrial Acreage	12
6-4	Water Supply Requirements	14
6-5	Irrigation Requirements in Year 2020	15
6-6	Principal Waste Discharges Along the Jackson and James Rivers	16
6-7	Flow Required for Water Quality Control, In CFS	18
6-8	Summary of Identified Needs	24
6-9	Analysis of Major Reservoirs, First Screening	30
6-10	Summary of Preliminary Economic Analysis of Major Reservoirs	33
6-11	Upstream Watershed Projects Studied	36

CHAPTER 6 - SHAPING THE PLAN FOR SUB-REGION C

LIST OF FIGURES

Figure No.	Title	Page II-6-
6-1	Projections of Employment and Population	2
6-2	Relation of James River Watershed to Sub-Region C	6
6-3	Flood Damage Zones-James River Basin	8
6-4	Communities Wherein Suitable Land Tracts are Available for Industrial Development	11
6-5	Flow Required for Water Supply and Water Quality Control in Year 2020	19
6-6	Recreation and Fish and Wildlife Needs in Sub-Region C	21
6-7	Major Reservoirs Investigated	31
6-8	Schematic of Water Needs and Alternative Solutions	37
6-9	Plan of Development	53

CHAPTER 6 - SHAPING THE PLAN FOR SUB-REGION C

SECTION I - FUTURE GROWTH PATTERN

1. WATER SUB-REGION

As previously discussed in Chapter 5 (see Section II), the Office of Business Economics delineated two areas (Economic Areas 10 and 14) which affect the economic activities of the 5 Virginia Counties comprising Sub-region C (see Figure 5-14, Pg. II-5-39, for delineation). OBE prepared projections of future employment and population growth for the areas, and these, in turn, were disaggregated to the boundaries of Water Sub-region C. A detailed presentation of the projections are shown in Appendix E and are summarized below.

	Year			
	1960	1980	2000	2020
Sub-region "C"				
Population	57,085	66,000	73,000	95,000
Employment	19,739	25,000	28,000	37,000

The above projections reflect a normal public investment program; that is, no special programs aimed at stimulating economic development are considered. With the stimulation to be provided by the Appalachian program, a new set of objectives, in terms of population, employment, and income were developed. These new objectives are called developmental benchmarks, and are intended to measure and describe the amount of growth that can occur as a result of an accelerated program of public investment. The benchmarks are also presented in detail in Appendix E and are summarized below.

	Year			
	1960	1980	2000	2020
Sub-region "C"				
Population	57,085	66,000	90,000	110,000
Employment	19,739	29,000	35,000	42,000

The implications of the developmental benchmarks are that additional or accelerated public and private investments will be needed, and, further, that these investments will be made in sufficient magnitude and at strategic locations so that the existing economy will be boosted to a higher and more competitive level. The water resources program for Sub-region C is being planned and evaluated within the objectives set by the developmental benchmarks. A comparison of the OBE projections and benchmarks projections for the sub-region are shown in Figure 6-1.

Figure 6-1. Projections of Employment and Population.

2. DEVELOPMENTAL CONSTRAINTS

The most serious constraint to the economic development of the Sub-region probably has been the lack of emphasis on planning activities at the local level. Another persistent handicap is the limited cooperation among the people of adjacent counties and cities in the region. These have led to a related problem of widespread lack of adequate zoning ordinances which, in turn, have caused careless preemption of choice industrial sites by commercial and residential construction.

Other noteable constraints are limited education and skill levels, which have compounded the problems of adjusting to new jobs; and health

needs, including serious shortages in the number of physicians, dentists, and hospital beds; the lack of adequate sewage and water treatment facilities; and gross pollution of several streams.

The rugged terrain is also a factor seriously restricting growth in several parts of the region, where steep slopes restrict the land available for building construction, retard highway construction, and cause severe and frequent flooding. Climate and terrain are also responsible for air pollution, inherent to parts of the sub-region, because of frequent low-level temperature inversions in the atmosphere. This problem is of increasing concern to the State in regard to developmental planning.

To evaluate, and hopefully solve many of these problems, the State planning division has recently augmented its staff with local planning specialists. Effort is also being made to improve planning at the local level. A great deal of effort and coordination at the lower level will be required to reach the goals and objectives of the Appalachian Program. Perhaps, the creation of a regional planning agency which would coordinate all planning activities within the five-county area (as well as with adjacent counties) would be of substantial benefit to future development of the sub-region.

3. PATTERN OF GROWTH ANTICIPATED

The future growth of the sub-region is dependent upon increasing industrial employment in Alleghany County, the expansion of metropolitan Roanoke into Botetourt County, and the provision of goods and services to the recreationists who visit the sub-region.

Manufacturing is expected to continue to be the leading employer within the sub-region, although relative to total employment, it is projected to decrease from the 1960 level of 36.1 percent to 31.0 percent in 2020. The paper and carpet industries located in the Covington-Clifton Forge growth center will continue to influence the growth in Alleghany County. OBE projections indicate that gross output per employee in the paper industry will increase from $9,568 in 1960 to $17,068 in 2020. Similarly, the output in textiles is expected to increase from $5,271 to $35,877 per employee.

Much of the projected economic growth of the sub-region will result from residential and industrial expansion of the City of Roanoke into Botetourt County. In OBE Sub-region 14, in which Roanoke is the major center, employment is projected to increase about 2-1/2 times by 2020. Manufacturing, trade and service industries will provide most of the increased employment. Presently, residents of Botetourt County are an important source of labor supply for the Roanoke industries, as about 40 percent of its workers commute daily to jobs outside the County. As

expansion continues northward along highways I-81 and U. S. 220, many residential and industrial sites in Botetourt County are expected to be developed.

Present and future recreation activity is also significant to the economic growth of the sub-region hinterlands. Increased population, higher per capita income, and improved transportation facilities are expected to greatly increase the demand for outdoor recreation facilities. Recreation needs, in terms of recreation days, are projected to increase from 100,000 in 1965 to nearly eight million in 2020. Such substantial increases in recreation needs will provide significant economic impetus to the sub-region through full utilization of existing facilities and the construction of additional facilities.

SECTION II - WATER-RELATED NEEDS

4. INTRODUCTION

As shown in Figure 6-2, the boundaries of Sub-Region C coincide generally with those of the James River Basin. More than 90 percent of the area of Sub-region C is within the James River Watershed. Moreover, the sub-region contains about 22 percent of the James River Watershed area, and is physically located in the important headwaters of the basin.

Since development of water resources in the sub-region would affect the stream's flows throughout the lower basin, it was necessary to describe the downstream needs along with the needs of the sub-region. Further, to insure complete compatibility of planning, the needs on all major tributaries upstream from Lynchburg were considered in the plan formulation and are described. The needs for the James River Basin are those which remain after construction of the Gathright Project is completed and is in full operation.

A comprehensive study of the water-related needs and resources of the James River Basin is underway. The needs and elements of a plan for proper development of the water resources of the watershed are not fully developed at this time. However, it is known that the plan of development will include (a) construction of Hipes Reservoir as described later in this chapter, (b) consideration of other reservoirs including small headwater improvements on tributaries in the James River Watershed to further meet the urgent need for flood damage reduction and for increased low water flow in the lower James River at Richmond and further downstream, and (c) local protection projects. Water-based recreation will be an important feature of some of these projects.

5. PROBLEMS IN GENERAL

The water and related land resource needs in the Alleghany County and Botetourt County growth centers are primarily concerned with flood control, maintenance of stream water quality, water supply, industrial, commercial and residential site development, and recreation. The needs of the smaller communities outside of the growth centers are primarily concerned with flood control, water supply, and recreation, as well as conservation, treatment and management of agricultural and forest lands. Needs of the major downstream cities are water supply and water quality control.

Specific water resource problems in the sub-region and in major downstream cities are discussed in the following paragraphs.

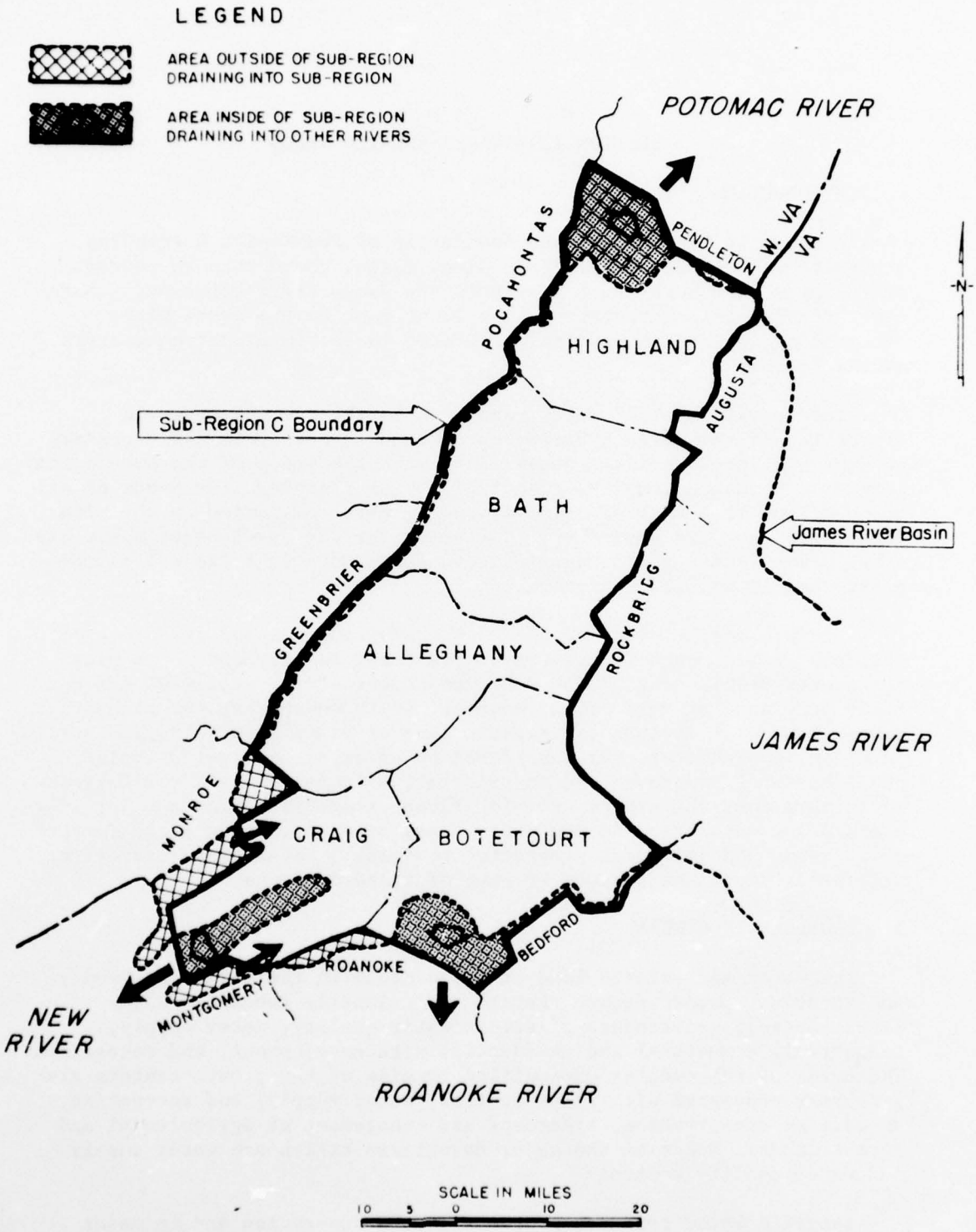


Figure 6-2 Relation of James River Watershed to Sub-Region C

Flood Control

The floodwater damages to urban, rural, and agricultural areas and to transportation and communications facilities, should be reduced to provide the opportunity for economic growth and development in the sub-region. Prior to the great flood of August 1969, the last major flood occurred in March 1936. Historically, major flooding has occurred along the Jackson River and to small rural and urban areas along the James River in Appalachia.

Gathright Reservoir, now being constructed on the headwaters of the Jackson River as shown on Figure 6-3 will provide substantial flood protection in the Alleghany County growth center. The project would have reduced the March 1913 flood peak by nine feet at Covington above Dunlap Creek, and by five feet below Dunlap Creek. Flood damages on an average annual basis will be reduced about 95 percent at Covington and about 60 percent in other urban areas such as Clifton Forge, Eagle Rock, and Buchanan. Significant flood damage reduction will be accomplished below the limits of Appalachia ranging from nearly 35 percent at the large industrial center of Lynchburg; 20 percent as far downstream as Scottsville; and to a lesser extent at Richmond, Virginia.

Between Gathright Dam and Dunlap Creek, the 100-year flood will be kept essentially within bank full stage. At Covington, some 150 acres of land covered by the 1913 flood, will be relatively free from flooding in the future, and thereby encourage increased development thereon. Downstream from Covington, land will be protected to a lesser degree. Average annual flood damages remaining, after completion of Gathright Reservoir, are $57,000 along the Jackson and James Rivers in Appalachia, as shown in the following table. Figure 6-3 delineates the areas by zones in which flood damages were identified.

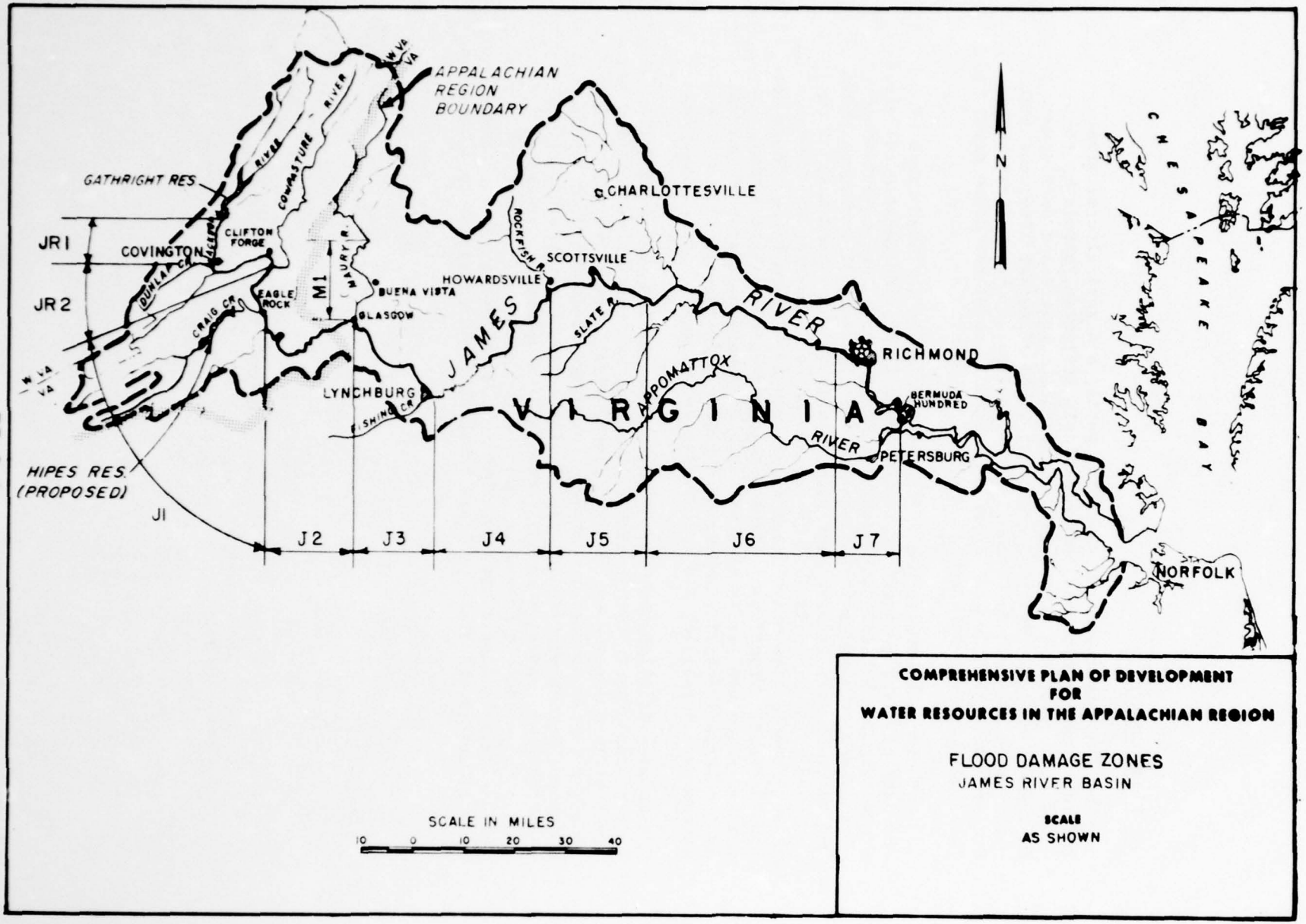

APPALACHIAN REGION BOUNDARY
GATHRIGHT RES
JR1
JR2
COVINGTON
CLIFTON FORGE
DUNLAP CR
CRAIG CR
EAGLE ROCK
M1
MAURY R
BUENA VISTA
GLASGOW
LYNCHBURG
FISHING CR
HIPES RES. (PROPOSED)
J1
J2
J3
J4
J5
J6
J7
CHARLOTTESVILLE
ROCKFISH R
SCOTTSVILLE
HOWARDSVILLE
JAMES RIVER
SLATE R
APPOMATTOX RIVER
RICHMOND
BERMUDA HUNDRED
PETERSBURG
NORFOLK
CHESAPEAKE BAY
N
SCALE IN MILES
10 0 10 20 30 40
COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION
FLOOD DAMAGE ZONES
JAMES RIVER BASIN
SCALE
AS SHOWN

FIGURE 6-3

TABLE 6-1
AVERAGE ANNUAL FLOOD DAMAGES ALONG JAMES RIVER
AND MAJOR TRIBUTARIES UPSTREAM FROM LYNCHBURG WITH
GATHRIGHT PROJECT IN OPERATION (a)

Damage Zone	From	To	Damages (b)
	Jackson River		
JR1	Gathright Dam Site	- Dunlap Creek	$ 1,000
JR2	Dunlap Creek	- Mouth	7,000
	James River		
J1	Mouth of Jackson R	- Craig Creek	9,000
J2	Craig Creek	- Maury River	40,000
Total in Appalachia			$ 57,000
J3	Maury River	- Fishing Creek	136,000
J4	Fishing Creek	- Rockfish River	72,000
J5	Rockfish R.	- Slate River	94,000
J6 and J7	Slate River	- Richmond More than	$1,000,000
	Maury River		
M1	Maury Dam Site	- Mouth	$ 285,000

(a) The effect of the great flood of August, 1969 has not been evaluated in the establishment of the above damage estimates.

(b) Includes allowance for future development of flood plain, which is expected to occur in the absence of flood control projects.

A portion of the average annual damages shown in the above table occurs in Botetourt County and adjoin the growth center in this county. Included are Zones J-1 and J-2. These include the small communities of Eagle Rock and Buchanan.

Additional areas, not shown in the above table, are subject to flooding along the tributaries and headwater streams of the Jackson and James Rivers in Sub-region C. These include rural sections of the Alleghany County growth center, the Botetourt County growth center, and in the remainder of the sub-region. According to the Department of Agriculture, a considerable portion of the damages in these areas are classed as major improvements. Average annual damages in these areas are estimated to be about 572,400 dollars. They are classified in the following table (Table 6-2). Watershed locations are shown on Figure 6-8 (pg. II-6-37).

TABLE 6-2
AVERAGE ANNUAL DAMAGES IN UPSTREAM WATERSHEDS

Watershed and State	Crop and Pasture	Other Agriculture	Residential and Commercial	Road and Bridge	Indirect	Total
Cowpasture, Va.	$21,770	$ 7,620	$ 96,290	$21,520	$26,940	$174,140
Catawba Cr., Va.	3,900	1,400	9,600	4,300	3,400	22,600
Dunlap Cr., Va.	3,200	1,290	35,860	4,420	8,570	53,340
Jackson Rv., Va.	4,120	1,440	46,980	6,380	11,330	70,250
Jackson Rv 4, Va.	10		10,720		2,150	12,880
Jackson Rv 5, Va.			35,220	2,330	7,460	45,010
Ogle Creek, Va.	140		30,890	3,160	6,030	40,220
Back Creek, Va.	1,720	605	17,140	7,910	5,275	32,650
Calfpasture R, Va	6,760	2,310	35,120	19,950	12,040	76,180
Potts Creek, Va.	3,060	1,070	26,510	7,300	7,240	45,180
Total	$44,680	$15,735	$344,330	$77,270	$90,435	$572,450

The present economy of the sub-region is dependent in part on agriculture and timber production. The small amount of flood plain soils is very productive, and the rainfall and weather conditions are conducive to good yields, but the area is subject to frequent inundation. Previous agricultural and timber harvesting practices caused considerable erosion and deposition of the material on the bottomlands. Some type of flood prevention project is necessary to reduce storm runoff and floodwater damages to crops and pastures, to encourage better farming practices, and for more intensive use of the flood plain land. Channel clearing and snagging and debris removal are required on portions of the watersheds of the Cowpasture and Jackson Rivers and Catawba Creek. Land treatment and improved forestry management are required throughout the sub-region.

Land Development and Management

An analysis of U.S. Geological Survey Quadrangle Maps was made to determine the best available industrial sites within each county. These sites were reconnoitered and selected based on topography, highway and rail access, proximity of cities and towns, availability of water, and economic reports by state, county, and private planning interests. The analysis indicated that sufficient amounts of relatively flat land are available in Sub-region C, particularly in the Alleghany County and Botetourt County growth centers to more than accommodate the projected industrial expansion. All of the potential industrial sites are generally surrounded by substantial amounts of suitable land for residential, commercial, and related development. Figure 6-4 shows the location of communities wherein suitable land tracts are available for industrial development. The available acreage by communities is shown in Table 6-3.

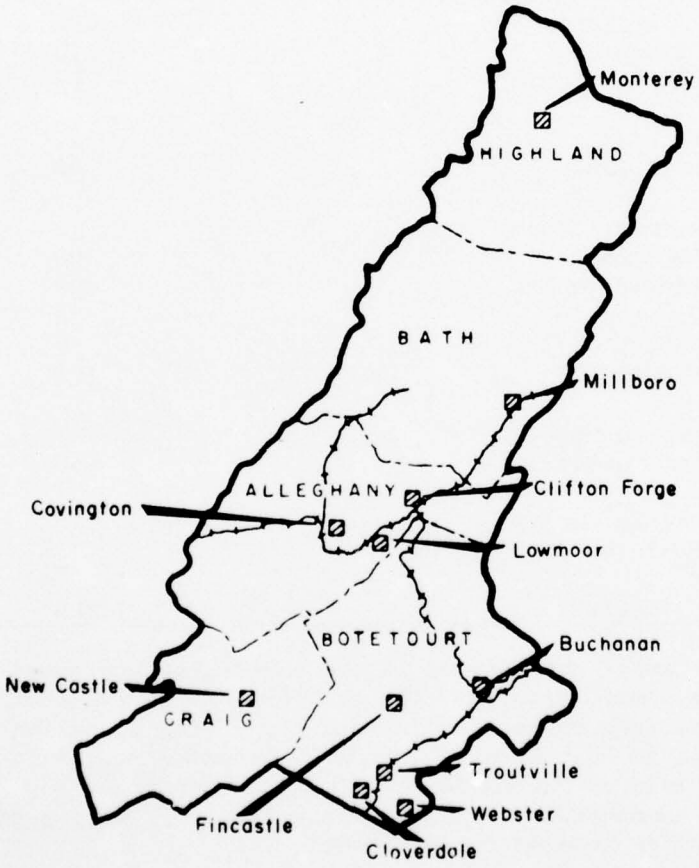


Figure 6-4 Communities Wherein Suitable Land Tracts are Available for Industrial Development

TABLE 6-3
POTENTIAL INDUSTRIAL ACREAGE

Location	Industrial Acreage
Alleghany County	
Covington	240
Lowmoor	70
Clifton Forge	160
Bath County	
Millboro	40
Botetourt County	
Buchanan	100
Fincastle	100
Troutville	30
Webster	50
Cloverdale	300
Craig County	
New Castle	50
Highland County	
Monterey	25
Totals	1,165

Many of the small communities in the sub-region are noted particularly for their summer resorts. Communities that derive their major source of income from recreation include Hot Springs, Healing Springs, and Warm Springs in Bath County, and McDowell and Monterey in Highland County. Water related recreation is almost non-existent in, and adjacent to, these communities. The Gathright Reservoir will augment these activities in some of these areas.

Large amounts of land are available for outdoor recreation in the National Forests and on various State lands. However, as a result of steep terrain and lack of access, much of this land is unsuited for development. Also, additional land would be required for water-based recreation associated with newly constructed reservoirs. New roads will be an important factor in the expansion of the area's tourist business and outdoor water-based recreation.

Land to be developed for agriculture is small due to the narrow valleys and steep mountain sides. The richest lands are the bottomlands along creeks and these are sparse, at intermittent locations, and are flooded periodically. Protection of these rich bottomlands from flooding would permit their further development. The probable needs of agricultural lands by 1980 are summarized in the paragraph which follows:

It is estimated that about 2,600 acres of cropland should be converted to less extensive use such as pasture, woodland, and wildlife, and 33,800 acres of cropland need treatment to control erosion. Excess water is expected to be a dominant problem on 9,200 acres and unfavorable soil conditions on an additional 5,900 acres. Pasture land treatment will include pasture planting on about 29,300 acres, and improvement of vegetative cover on another 61,100 acres. Protection of pasture land from overgrazing and invasion of undesirable plants are needed for an estimated 34,200 acres. 350 acres of spoil area from surface mines will need to be reclaimed to keep pace with the surface mining operation.

The U.S. Forest Service cooperates with state forestry agencies in the protection and management of over 635,900 acres of privately-owned forest and woodland. There are also 537,700 acres of National Forest land administered by the U.S. Forest Service. Of these lands, about 1,900 acres will require measures to combat erosion; improvement of timber stands will be required on 158,200 acres; and protection from grazing by livestock will be required on 237,300 acres. It would be desirable to acquire about 130,000 acres for National Forest lands to help meet the demands for public use of forest resources. Some of this land would be acquired from small private ownership within the exterior boundaries of the public forest lands.

Water Supply

The water which races down the tributaries and streams in times of flooding is often in short supply to meet the growing demands of domestic and industrial water usage. One of the serious problems, particularly in the Alleghany County growth center's water supplies, is the quality of the water. Many of the wells are high in iron, sulphur, and calcium. The formation in which the wells are located in general contain caverns and open seams which permit the entry of surface waters and possible contamination of the ground water supplies. The Virginia Health Department has reported finding evidence of ground water pollution in many wells and the pollution trend is increasing.

The following table shows the present and projected use of streams by the large municipalities in Sub-region C, and along the main stem of the James River downstream from the sub-region.

AD-A041 387 CORPS OF ENGINEERS CINCINNATI OHIO F/G 8/6
DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. MAIN REPORT. PART--ETC(U)
NOV 69

UNCLASSIFIED NL

7 OF 7
AD
A041387

END

DATE
FILMED
7-77

TABLE 6-4
WATER SUPPLY REQUIREMENTS

Area Location	Stream	Average Daily Municipal and Industrial Demand, in MGD 1965	1980	2000	2020	Available in Stream, in MGD (a)
Covington-Clifton Forge	Jackson	39	72	82	85	36
Lynchburg	James	30	48	66	90	144
Richmond	James	52	102	157	177	226

(a) Minimum daily flow.

The above table indicates that the expanding industry in the Covington-Clifton Forge area will require additional raw water to meet future needs. It is anticipated that the primary source of industrial supply will be the Jackson River. An adequate volume of water of suitable quality will be available following completion of the Gathright Reservoir, and is discussed in detail later in this chapter.

An adequate supply of water is essential to the continued economic expansion of the Botetourt County growth center. It is estimated that the population of Botetourt County will increase about three times by 2020. A substantial portion of this increase will result from the growth of metropolitan Roanoke expanding into the southern portion of Botetourt County, possibly as far north as Fincastle. The reservoir supplying water to the metropolitan area of the City of Roanoke is located on Carvin Creek within the limits of the Botetourt County growth center, as shown on Figure 6-7, (pg. II-6-31). This source provides an average of 15 mgd, which is the major capacity of the present system for about 200,000 persons. The City of Roanoke's water supply needs are discussed later in this section.

The average consumptive water demand for Botetourt County is not expected to exceed six to eight mgd by year 2020, with much of the demand in the southern or growth portion of the county. The community of Buchanan, located on the James River and with good highway and rail connection, is also expected to expand. Its' publicly-owned system is supplied by ground water and is presently operating at 30 percent of total capability. Ground water resources are sufficient to supply additional needs when required.

In the outlying areas of the sub-region, the water supply needs are presently provided by springs, wells, and, to a lesser extent, by small existing reservoirs and unimpounded streams. During extreme dry periods, water supplies are now inadequate in several locations, such as the

communities of Monterey, McDowell, Millboro Springs, Mitchelltown, Hot Springs, Healing Springs, and Warm Springs, shown on Figure 6-7, (pg. II-6-31). Each of these communities currently uses between 20,000 gallons and 100,000 gallons per day.

Most of the future supplies for the Alleghany and Botetourt County growth centers are expected to be obtained from surface sources, while the supply for many of the smaller communities will, in most instances, continue to be provided by wells or springs. However, when the latter sources no longer become dependable, it will be necessary to develop impoundments for storage of surface runoff or provide conveyance from a dependable source.

Irrigation

Rainfall is usually sufficient during the crop-growing season and the present practice of supplemental irrigation is limited. The following table shows the probable future irrigation requirements for Sub-region C. They were estimated by the Economic Research Service and Soil Conservation Service of the U.S. Department of Agriculture.

TABLE 6-5
IRRIGATION REQUIREMENTS IN YEAR 2020

Month	Irrigation Requirements, cfs	
	Total	From Streams
April	5	1
May	20	4
June	31	6
July	31	6
August	28	6
September	9	2
Total	124	25

The stream flow is in excess of the above irrigation needs. However, substantially all water withdrawn for irrigation is lost through evaporation and transpiration, thereby reducing the supply of water downstream.

Maintenance of Stream Quality

According to the Federal Water Pollution Control Administration, the Jackson River above Covington, and the tributaries of the James in Sub-region C - Dunlap, Potts, Craig, and Catawba Creeks, and Cowpasture River - are of good quality for all uses. The communities on those tributaries are relatively small with populations of several hundred to a thousand. Usually sewerage systems include primary treatment plus chlorination. A few communities also include secondary treatment. Consequently, the smaller, fast flowing streams throughout the sub-region provide clean, clear water for water supply for existing fish and wildlife. They can

assimilate the small amount of treated pollutants and recover quickly. These tributary streams are also aesthetically satisfactory as one sees them flowing through the beautiful mountain and valley terrain.

Although the water entering the lower Jackson River is of good quality, it becomes grossly polluted at Covington and vicinity. The discharge of untreated and partially treated municipal and industrial wastes causes a load that is far in excess of the assimilative capacity of the stream and the dissolved oxygen content falls to zero in the summer of some years. These conditions extend downstream from Covington for a distance of 24 miles.

Degradation of the water quality results in creation of health hazards, severe nuisance conditions, and elimination of aquatic and fish life. It makes the stream unusable as a source of water supply and for critical quality uses without extensive treatment. Fishery resources are severely affected by pollution. Despite the occasional presence of fish, the waters in this river section are virtually worthless, providing only occasional low quality fishing opportunity.

The three areas of major pollution along the Jackson and James Rivers are the Covington-Clifton Forge area, Lynchburg and vicinity, and the estuary of the James River. The following table lists the major waste contributors.

TABLE 6-6
PRINCIPAL WASTE DISCHARGES ALONG THE JACKSON AND JAMES RIVERS

Location	Type of Waste	Type or Efficiency of Waste Removal	Waste load discharged, Population Equivalent
Sub-region C			
Covington	Municipal	Primary	8,500
Clifton Forge	Municipal	Primary	5,000
Lowmoor	Municipal	None	600
Iron Gate	Municipal	Primary	600
Selma	Municipal	Primary	700
West Virginia Pulp and Paper Co. Covington	Industrial	Secondary	50,000
Total - Sub-region C			65,400
Downstream from Sub-region C			
Lynchburg	Municipal and Industrial	Various	246,000
Richmond	Municipal and Industrial	Various	435,000
Total Jackson & James Rivers thru Richmond			764,000

The Commonwealth of Virginia has established specific water quality objectives for the entire James River Basin, including the portion in Sub-region C. The Virginia Water Control Board has generally used the following basic criteria in the past: (1) dissolved oxygen not less than 5.0 mg/l in the stream; (2) no appreciable floating or settleable solids; (3) no noticeable coloration or discoloration of the receiving stream; (4) toxic substances to be reduced below the toxicity limit of the stream; (5) no appreciable change in pH of the receiving stream; and (6) stream flow for design of sewerage treatment facilities equal to minimum average seven-day low flow, occuring on a ten-year frequency.

In the Jackson River and the James River above Richmond, the primary uses to be preserved are: water supplies, fish and aquatic life of the stream (biological characteristics), and recreation. Periods of degraded water quality adversely affect the fish and aquatic life of the stream to a greater degree than the other primary water uses. Water of a quality sufficient to protect the fish and aquatic life in the stream also provides water quality satisfactory for other beneficial uses. For this reason, the biological characteristics of the stream have been given primary consideration. The parameter most affecting the stream's biological characteristics is the dissolved oxygen (D.O.) in the stream.

The Federal Water Pollution Control Administration has stated that:

> "To adequately protect and enhance water quality in the face of population and industrial growth, urbanization, and technological change, water pollution control action, in addition to the provision of conventional waste treatment facilities, is needed in areas where stream flows are low in comparison to the existing and/or projected residual BOD loads which the stream must assimilate.
>
> "Reservoir storage to provide supplemental flow for water quality control is a possible solution to supplemental water pollution control needs in the areas in the James River Basin where a need for greater than 85 percent removal of BOD in waste discharges is indicated."

An intensive study of the James River Basin has been made by the Federal Water Pollution Control Administration to evaluate the present and projected needs for low flow augmentation for water quality control. Flow requirements are based on (a) removal of 85 percent of the five-day BOD of the waste by conventional secondary treatment or other means, and (b) maintaining a minimum of five parts per million dissolved oxygen in the stream. At three locations, flow requirements exceed natural flow and low flow augmentation would be a technologically feasible method of meeting water quality objectives. The range of flow required is shown in the following table. The seven-day, ten-year frequency low flow is also shown to indicate the deficiency of natural flow. The Federal Water Pollution Control Administration recommends that when considering

low flow augmentation, storage capacity should be designed to supply the required flow with a probability of failure of one month in 20 years.

TABLE 6-7
FLOW REQUIRED FOR WATER QUALITY CONTROL, IN CFS

Year	Covington		Lynchburg		Richmond	
	Winter	Summer	Winter	Summer	Winter	Summer
Present	82	129	220	690	(a)	(a)
1980			230	720	(a)	850
2020	175	365	320	1,100	400	1,800
7-day, 10-year frequency low flow		78		427		711

(a) Less than minimum flow of record.

Figure 6-5 indicates the flow required in year 2020 for water supply and water quality control at major communities in the watershed. Gathright Reservoir will improve, to a degree, the quality of the water along the Jackson and James Rivers as indicated later in this chapter.

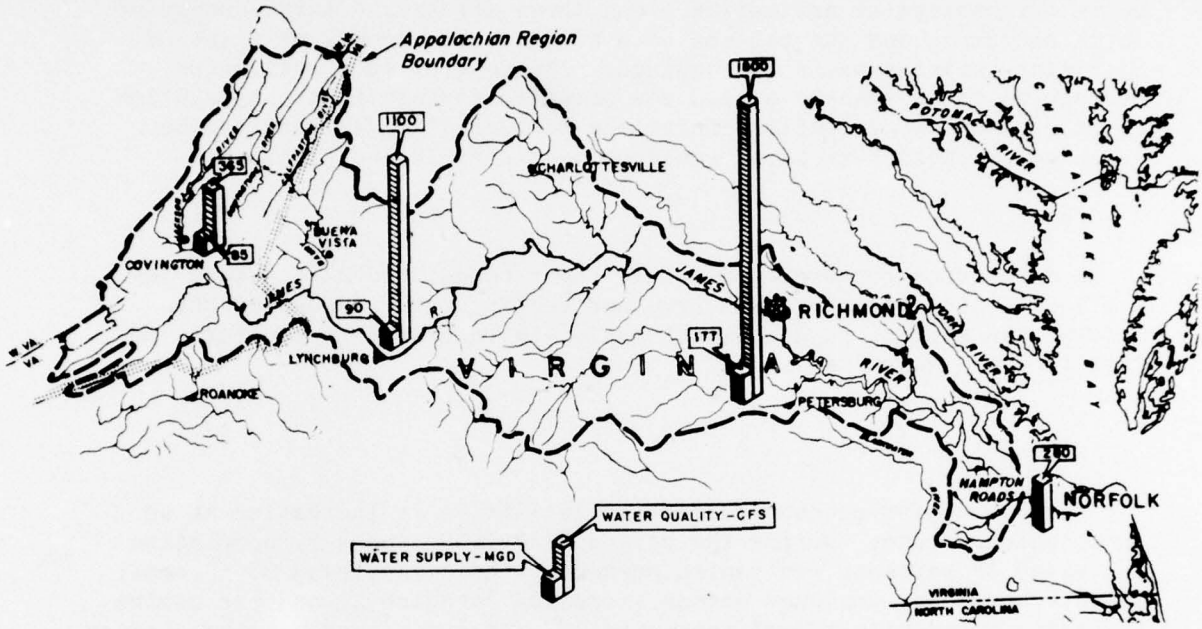


Figure 6-5 Flow Required for Water Supply and Water Quality Control in Year 2020

Navigation

There is at present no commercial navigation on the James River and tributaries upstream from Richmond. Navigation from Richmond to Buchanan in Sub-region C was provided by the James River and Kanawha Canal until 1878 when the canal was abandoned. A report on James River prepared by the Corps of Engineers and published in 1934 in House Document No. 192, 73rd Congress, 2d Session, usually referred to as the "308" report, stated:

> "Improvement of James River for navigation either alone, or in connection with power development, flood control, or irrigation, or any combination thereof, other than as authorized by existing law, should not be undertaken by the United States at the present time."

The James River and its tributaries in the sub-region have a steep gradient and contain rapids and shoals wherein the depth of water is negligible during the summer months. In order to provide a sufficient depth for commercial navigation along these streams, a large number of locks and dams, and the raising of a considerable number of miles of main line railroad would be required. The cost of such navigation structures would greatly exceed any possible savings in transportation costs. However, navigation consisting of recreational craft can be expected to develop in large reservoirs created in the area.

Power

A discussion concerning electric power needs, probable future installation of generating capacity, and cooling water needs for the Appalachian Region, on a regional basis, is contained in Chapter 4 of Part I, the Summary Report.

Recreation

The demand for outdoor recreation facilities is increasing at an unprecedented rate. During the period 1930-1960, the U.S. population increased 45 percent; per capita personal income increased 93 percent; leisure hours per employed person increased 54 percent; and per capita intercity automobile travel increased 182 percent. A growing population with a greater personal income, enjoying more leisure time and increased mobility, and living in a rapidly growing urban environment is placing greater emphasis on use of outdoor recreation facilities.

Figure 6-6 shows the estimated needs to accommodate water-based general and fish and wildlife recreation in Sub-region C as determined by the Bureau of Outdoor Recreation and Bureau of Sport Fisheries and Wildlife. As indicated, there was little unsatisfied demand or need computed for 1964-65 within the sub-region. However, the projected unsatisfied demand increases dramatically in future years.

Other

Land drainage is not considered to be a problem due to the steep mountain slopes and rapid runoff. While the amount of low-lying lands requiring drainage is negligible, 9,200 acres require drainage for improved agricultural production.

The reduction of erosion and sediment through land treatment measures will reduce damage downstream, maintain productivity on upstream areas, and improve water quality. There are areas in the sub-region; particularly in the upstream watersheds of the Jackson and Cowpasture Rivers, and Catawba, Dunlap, Ogle, and Potts Creeks; such as road banks and critically

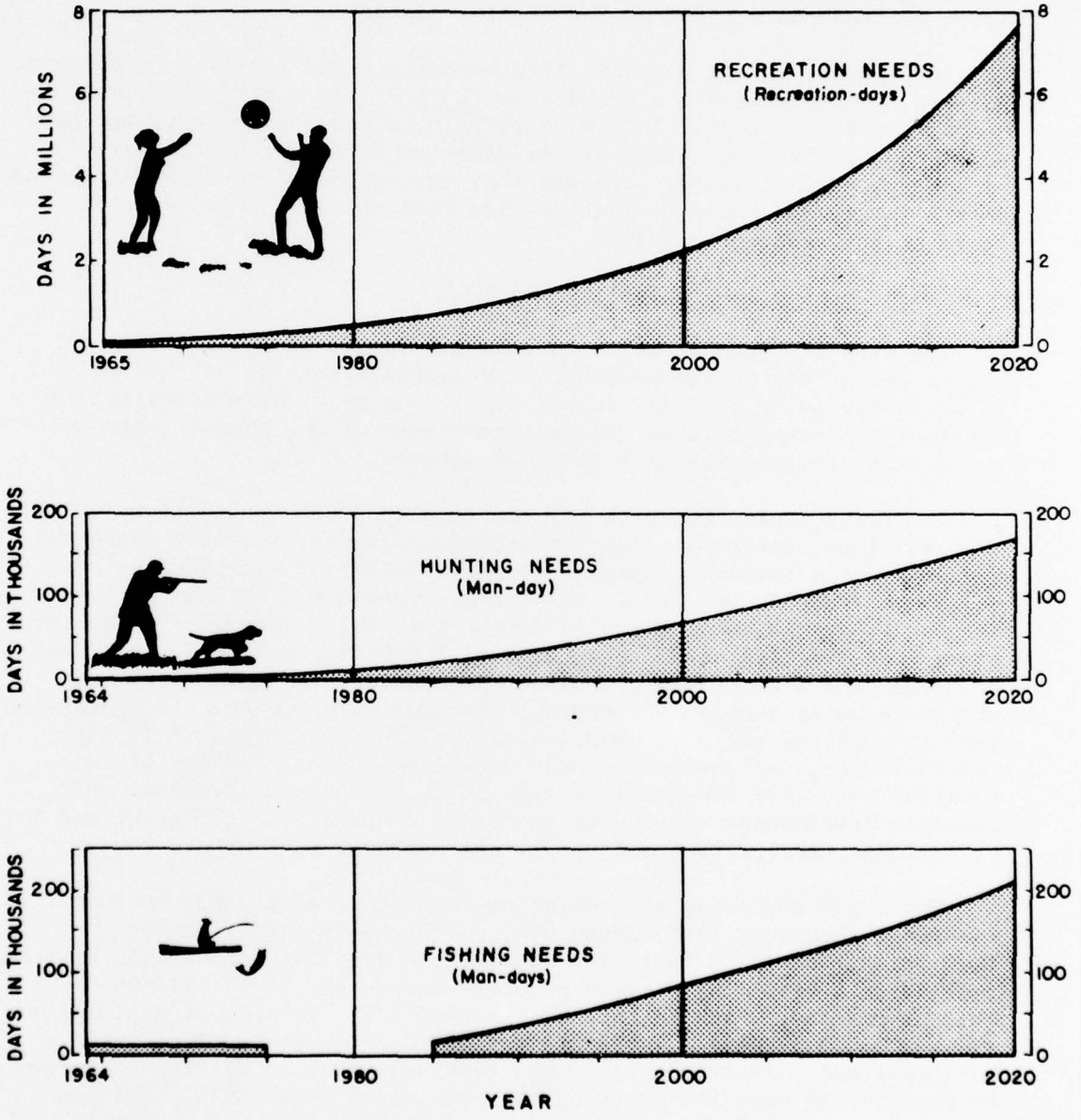


Figure 6-6 Recreation and Fish and Wildlife Needs in Sub-Region C

eroded land areas, that will require stabilization. Sheet erosion of the uplands, erosion of streambanks and idle lands, and new highway and other construction are additional sources of sediment. Land treatment measures are required to reduce the sediment contribution of those areas. Secondary roads, logging roads, and skid trails should be properly located and maintained for erosion control.

In general, insect problems in Sub-region C are localized and minor. Malaria is not presently a problem in the area since the anopheles mosquito is not prevalent. The steep terrain is not favorable to the production of the vector. However, in order to provide public health safeguards against vector problems that may arise, vector prevention and control measures should be incorporated into the design or planning stage of any reservoir project.

Needs Outside the James River Basin

The City of Roanoke, while outside the limits of Appalachia, will play a major role in the growth of the southern portion of Sub-region C, as discussed in Section I. Therefore, it was considered essential to consider the water-related growth impediments of the Roanoke metropolitan area in conjunction with those of Botetourt County.

In recent years, the area has experienced drought conditions which, when combined with widespread population increases, strongly indicated the need for a regional approach to the solution of obtaining an adequate water supply and resolving sewerage problems. As a result, the Roanoke Valley Regional Planning Commission, which comprises representatives from the City of Roanoke, Botetourt County, Roanoke County, Town of Salem, and Town of Vinton, employed a consulting engineer firm to prepare a water supply and sewerage plan for this region. In appraising the needs of the regional area, which includes the Botetourt County Growth Center, the consultant made detailed studies of rates of consumption and water requirements related to population, land use and economic development, including domestic, commercial, industrial and institutional uses. A summary report was prepared in February 1967.

The study indicated that existing facilities at the Carvin Cove Watershed Reservoir (see Figure 6-8, pg. II-6-37) and treatment facilities located in Botetourt County, are excellent and should be continued in use. This source provides an average of 15 million gallons per day, which is the major capacity of the present system for about 200,000 persons. The additional demand is met by other small municipal and private sources. The combined total of all these sources is expected to meet the needs of the area until about 1975. The projected future average daily demand, as presented in the consulting engineers' report, in millions of gallons per day is 31.5 in 1970, 41.0 in 1980, and 55.0 in 2000. Specific data are not available to indicate the extent of the need for streamflow regulation for either flood control

or water quality control in the Roanoke area; however, the consulting engineers did indicate that flow for a higher dilution ratio of the wastes would be desirable. It also seems that some need for reducing flood stages is likely to exist in this area.

Summary

A summary of identified needs within the sub-region is presented in Table 6-8. It also indicates the needs along the James River downstream from the sub-region, some of which can be met by reservoir developments within the sub-region.

TABLE 6-8

SUMMARY OF IDENTIFIED NEEDS IN SUB-REGION C AND LOWER JAMES RIVER (a)

State River Basin Growth Center	Water Supply (MGD)	Flood Control: Current Damage ($1,000)	Flood Control: Flooded Area (Acres)	Recreation Days (1000)	(a) Water Quality (1000 AF)	Power: Peak Demand (Gigawatts)	Power: Annual Energy (Gigawatt Hrs)
Virginia							
James River							
Alleghany Co.	0	8.8	1,200	(c)	0		
Botetourt Co.	0	50.1	3,300	(c)	0		
Total Growth Centers	0	58.9	4,500	(c)	0	(c)	(c)
Total Sub-Region C	0	631.3(d)	25,100(d)	7,600	0	(c)	(c)
Downstream from Sub-Region C (a)	0	1,452.0	25,800	(c)	182	(c)	(c)
Total James River (a)	0	2,083.3	50,900	(c)	182	55.5(b)	335,400(b)

(a) Indicates net needs (excluding those met by Gathright Reservoir) in the Year 2020 along main stem of James River below Sub-region C, some of which can be met by potential projects in Sub-region C.

(b) Total for Power Supply Area 18 which includes most of James River Basin.

(c) Not available.

(d) Includes upstream watersheds with present needs.

SECTION III - ALTERNATIVES FOR MEETING NEEDS

6. INTRODUCTION

Water resource needs which must be served to stimulate economic expansion in Sub-region C include flood control, water supply, water quality control and outdoor, water-based, recreation opportunities. There are now no existing major water resource improvements in the sub-region. Structural measures such as reservoirs, and non-structural measures such as land treatment, can be combined to attain planned objectives. Flood plain management will also be necessary in order to assure orderly development. Structural and non-structural measures considered relevant in formulating the water resource plan are discussed below.

7. STRUCTURAL

The Congressionally authorized Gathright Reservoir on Jackson River, now under construction, will provide for the control of floods, storage for low flow augmentation for water quality control as a supplement to adequate waste treatment at its source, and for water-based recreation.

New projects can be developed to serve the present and projected needs for flood control, water supply, water quality control, and recreation.

Flood protection can be provided by reservoirs, flood walls, levees, and in some cases channel improvements.

The projected water supply needs could be supplied either by a series of wells or by reservoirs. Water quality control needs following completion of Gathright will exist downstream from Sub-region C and can be met by a higher degree of waste treatment, by augmented stream flows, or a combination of the two. Water-based recreation needs in the region can be largely met by state parks, containing small lakes, small headwater reservoirs, or reservoirs on larger tributaries.

A combination of the above methods can be utilized to accomplish water development goals. These could include (a) large multiple purpose main stream reservoirs to furnish flood control and water quality control for such major rivers as the James and (b) headwater reservoirs and channel improvement for flood control and flood prevention and water supply in upstream watershed areas. Both major and minor reservoirs could furnish a measure of water-based recreation. In addition, individual wells and springs would be combined with these reservoirs to supplement the water supply need. Any combination of methods would require at least secondary treatment of waste

effluents from municipal and industrial plants. Higher treatment would also have to be considered if it is more economical than res-
effluents from municipal and industrial plants. Higher treatment would also have to be considered if it is more economical than res-ervoir construction. Small ponds would assist to accommodate some demand for fishing and water-oriented recreation.

The Gathright project, now under construction, will fulfill the major flood control and water quality needs in the Alleghany County growth center. It will also fulfill significant needs in the Botetourt County growth center and will to some extent provide flood control and water quality control to the need centers along the James River downstream from Sub-region C. This reservoir will also provide a potential for water supply and recreational opportunity, particularly in the Alleghany County growth area.

Additional major reservoir developments being a practical alternative for meeting the remaining needs, 28 major reservoir sites were considered as supplements to the Gathright Reservoir. Of the five sites (see Figure 6-7, pg. II-6-31) having the greatest promise, the Stackmine Reservoir on Dunlap Creek would have the greatest potential for benefiting the Alleghany County growth center because of its geographical location. Hays, Griffith, Hipes, and Stone House Reservoirs being located further downstream would have greater potential for meeting the needs of the Botetourt County growth center and need centers further downstream. Any of these reservoirs would provide significant flood control, water quality control, and water-based recreational opportunity.

About 140 possible reservoir sites were considered in arriving at a plan for the development of the upstream watershed projects. Of these projects, 47 were selected for more detailed study, all of which would provide flood protection. Sixteen would also provide non-agricultural water supply and ten would provide recreation in addition to flood protection. These projects are capable of providing flood protection, municipal, and industrial water supply and recreation facilities in communities and rural areas in outlying sections of the sub-region.

The expanding need for additional recreational opportunity can be met by proper development of existing streams, major and headwater reservoirs, state parks, and portions of the National Forests. Both the Hipes and Stone House Reservoirs provide excellent recreation potential. The Stone House Reservoir provides a relatively large lake and an abundance of land suitable for development, while the Hipes Reservoir affords unusual scenic views and is located within the Jefferson National Forest. While the Hays, Stackmine, and Griffith Reservoirs possess less potential for recreational development than either Hipes or Stone House, these reservoirs could provide significant recreational opportunities. Development of recreational sites within the National Forests without the benefit of a large lake would also appeal to large segments of the population.

An adequate supply of water to insure continued economic growth in the Roanoke area can be developed from groundwater and/or surface sources. To develop an adequate surface water supply numerous alternatives are available both within and outside of the Roanoke River Basin. Opportunities for development of a water source capable of meeting the needs of the entire region for many years into the future exist on the South Fork as well as the main stem of the Roanoke River. The existing Smith Mountain Reservoir located downstream from the city of Roanoke is also a potential water supply source within the Roanoke River Basin. Sources capable of meeting regional needs can be developed on the main stem of the James River as well as on Craig Creek, a major tributary of the James. An alternative to the development of a regional water supply capable of meeting the need far into the future, would be developments by the individual municipalities on small tributaries near the need centers. This is being accomplished at the present time.

8. NON-STRUCTURAL

The proper use and management of the flood plain are vital for meeting future economic growth. All flood plain areas should be zoned to promote orderly development and the best use of the land to meet future resource needs. In areas where level land is scarce, zoning will be necessary for residential, commerical, and industrial sites. In agricultural areas, conservation cropping systems should be planned and developed for flood plain lands.

Land treatment and management programs along with protection of forest land from fire, insects, and diseases, will reduce floodwater, erosion, and sediment damages, and help improve water quality. These programs provide an opportunity for making needed land use changes to meet the capability of the soil. Some of the mechanical practices which will be required include diversion terraces, grassed waterways, field ditches, tile drains, farm ponds, and grade control structures.

Proper treatment of highway and railroad fills with grasses to prevent erosion is always desirable. This is particularly true in mountainous terrain where slopes are steep and runoff heavy.

SECTION IV - EVOLUTION OF THE SUB-REGION WATER RESOURCES DEVELOPMENT PLAN

9. SELECTION OF BEST INDIVIDUAL SOLUTIONS

Structural

The prime objective of the water resource development plan proposed in this report is to reduce water-related impediments to growth potential in the sub-region. As indicated in Section II, the growth and development require the resolution of the flood, water supply, and water quality problems, as well as a meeting of the water-based recreation needs. An accelerated land treatment program and improved forest management is also necessary.

It is apparent that Gathright, when completed, will fulfill the major flood control and water quality needs in the Alleghany County growth center and fulfill significant needs in Botetourt County along the James River and downstream from the sub-region. It will also provide a potential for water supply and for water-based recreation.

In studying the James Basin as a whole and Sub-region C in particular, it was recognized that a major reservoir development in the sub-region, in addition to Gathright, would satisfy additional needs for flood control and water quality control along the James River in Botetourt County and downstream from the sub-region, and provide a conservation pool for water-based recreation pursuits so necessary in this mountainous but lakeless region, and thereby stimulate economic growth and opportunities. In order to insure that such a project is compatible with the plan now being prepared for the proper development of the water resources of the James River Basin, all major tributaries upstream from Lynchburg were considered in plan formulation.

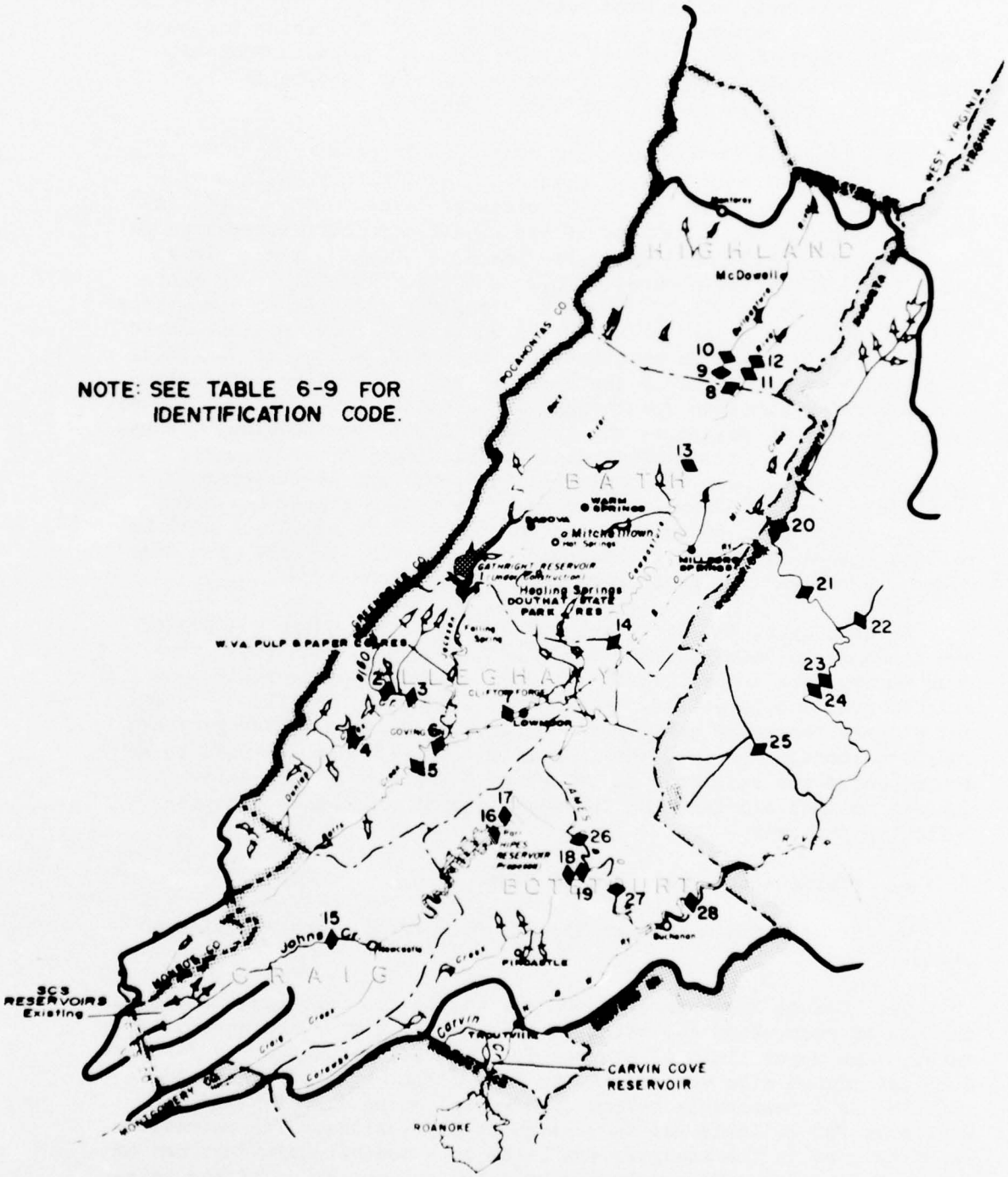
Reservoir sites were selected in the preliminary phase from map studies and from available data for sites considered in detailed engineering studies of the James River Watershed during the past 40 years. As a result, a total of 28 reservoirs located upstream from Lynchburg were investigated. Subsequently, field visits were made by engineers and geologists. This reconnaissance provided up-to-date information on possible engineering and geological problems which would be encountered, cultural development in the reservoir areas, and general attributes of the sites. Storage capabilities were developed in engineering studies, along with the relationships between storage capacity and structure size, and preliminary cost information. Those sites having obvious defects, such as unsuitable geologic conditions, excessive costs of relocations, and extremely poor cost to storage relationships, were eliminated from further consideration. In this manner, 28 sites were analyzed and compared. These sites, together with the most significant reason for rejection in this preliminary stage of analysis, are listed in Table 6-9. Their locations are shown on Figure 6-7.

PRECEDING PAGE BLANK-NOT FILMED

TABLE 6-9

ANALYSIS OF MAJOR RESERVOIRS, FIRST SCREENING

Location			Drainage Area		
	Dam Site				
Stream	Name	No.	sq.mi.	Disposition	Reason for Elimination
Jackson R.	Gathright	1	344	Under const.	
Ogle Cr.	Ogle	2	34	Eliminated	High cost of storage.
Ogle Cr.	Callaghan	3	44	Eliminated	High cost of storage.
Dunlap Cr.	Stackmine	4	103	Retained	
Potts Cr.	Hays	5	163	Retained	
Potts Cr.	Covington	6	170	Eliminated	Alternate Hays site better.
Jackson R.	King	7	812	Eliminated	Storage capacity small.
Bullpasture R.	Williamsville #3	8	92	Eliminated	Sinkholes and cavernous limestone in reservoir area make leakage probable. No local need for storage. Large storage available at Griffith site at moderate cost.
Bullpasture R.	Williamsville #2	9	104	Eliminated	
Bullpasture R.	Williamsville #1	10	108	Eliminated	
Cowpasture R.	Meadow Run #1	11	66	Eliminated	
Cowpasture R.	Meadow Run #2	12	66	Eliminated	
Cowpasture R.	McClung	13	218	Eliminated	
Cowpasture R.	Griffith	14	376	Retained	
Johns Cr.	Johns Creek	15	101	Eliminated	No local need for storage - Lower cost storage available at Hipes site.
Craig Cr.	Hipes	16	327	Retained	
Craig Cr.	Horton	17	333	Eliminated	Hipes site better.
Catawba Cr.	Stone House	18	111	Retained	
Catawba Cr.	Salisbury Furnace	19	115	Eliminated	Stone House site better.
Calfpasture R.	Whitesal	20	138	Eliminated	High cost of storage.
Maury R.	Maury	21	322	Eliminated	High cost. Extensive relocations.
Hays Cr.	Rockbridge Baths	22	82	Eliminated	High cost of storage.
Maury R.	Lexington	23	449	Eliminated	Kerr Creek site better.
Maury R.	Kerr Creek	24	450	Eliminated	High cost of storage.
Buffalo Cr.	Murat	25	80	Eliminated	High cost of storage.
James R.	Eagle Rock	26	1,830	Eliminated	High cost. Extensive relocations.
James R.	Lyle	27	1,980	Eliminated	Storage capacity small.
James R.	Varney Falls	28	2,150	Eliminated	Storage capacity small.



COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION

MAJOR RESERVOIRS
INVESTIGATED

FIGURE 6-7

Five reservoir sites were retained for further study as a resul of this initial screening. These sites were (a) Stackmine on Dunlap Creek, (b) Hays on Potts Creek, (c) Griffith on Cowpasture River, (d) Hipes on Craig Creek, and (e) Stone House on Catawba Creek. See Figure 6-8, Page II-6-37 for their locations.

Data on these five sites were developed in greater detail. Some field surveys and borings were required. Preliminary designs and cost estimates were made for three sizes of development. A preliminary evaluation was also made of the amount of water resource goods and services provided and the value thereof. Each of these sites would provide for the control of floods and for low-water regulation for water quality control, primarily along the James River downstream from Sub-region C. Each of the sites would also provide water-based recreation and expansion benefits. While power, either conventional or pumped storage, could be installed in any of the five sites, the most favorable location was thought to be at the Hipes site. A detailed study was made to determine whether power should be included. It was found that, although a conventional installation, of the six plans considered, would pass the comparability tests and be economically feasible, a project without power would provide a higher net benefit return. Therefore, power has been omitted at this time, but will be reinvestigated during detailed engineering design studies. For this reason, power was not considered at the other four sites.

At each site, detailed analyses were made for three heights of dam in order to determine the scale of the project that would provide maximum net annual benefits. Each alternative reservoir considered provided three watershed inches of storage for flood control and storage for water quality control. Each reservoir also provided inactive storage not less than the volume of sediment expected to be deposited in the reservoir in 100 years. The storage for water quality control was taken as the least amount consistent with the following criteria:

a. Drawdown not more than 30 feet.

b. Storage not more than 750 ac. ft. per sq. mi. of drainage area.

The 30-foot limit on drawdown was adopted so that maximization of the sum-of recreation and water quality benefits would be approximated. The upper limit of storage for low-flow regulation of 750 acre feet per square mile was adopted to insure that the storage would be refilled in a reasonable period of time following drawdown and be available for reliable use in subsequent dry periods. The recreation benefits used in the analyses are based on a moderate drawdown and are considered to be sufficiently accurate for an evaluation of the relative merits of reservoirs at alternate sites.

Table 6-10 shows the results of this analysis for each of the five reservoirs that were studied in detail. It presents physical and economic data for the scale of development providing the maximum net benefits for each project, assuming the other four are not constructed. In

TABLE 6-10

SUMMARY OF PRELIMINARY ECONOMIC ANALYSES OF MAJOR RESERVOIRS

	Stackmine	Hays	Griffith	Hipes	Stone House
PHYSICAL DATA					
Location: Stream	Dunlap Creek	Potts Creek	Cowpasture R.	Craig Creek	Catawba Creek
Dam, river mile	17.9	5.6	13.7	14.8	3.6
Drainage area, square miles	103	163	376	327	111
Type of dam	Earth	Concrete	Earth	Earth	Concrete-Earth
Type of spillway	Gated	Gated	Gated	Gated	Gated
Maximum Height of dam, feet	170	174	182	170	128
Reservoir elevation, feet above msl					
Top of dam	1630	1420	1310	1185	1108
Top of spillway gate	1620	1410	1300	1175	1098
Maximum conservation pool	1608	1394	1288	1165	1095
Minimum conservation pool	1578	1364	1258	1135	1074
Storage capacity, acre feet/watershed inches					
To top of spillway gate	82,500/15.0	122,000/14.0	380,000/19.0	305,000/17.5	220,000/37.2
Flood control	16,500/ 3.0	26,000/ 3.0	60,000/ 3.0	52,000/ 3.0	18,000/ 3.0
Conservation (a)	29,000/ 5.3	46,000/ 5.3	130,000/ 6.5	121,000/ 6.9	85,000/14.4
Sediment and inactive	27,000/ 6.7	50,000/ 5.7	190,000/ 9.5	132,000/ 7.6	117,000/19.8
Reservoir surface area, acres					
At maximum conservation pool	1180	1650	5000	4770	4670
At minimum conservation pool	810	1200	3600	3400	3400
ECONOMIC DATA					
Construction cost and investment					
Dam and appurtenances	$10,650,000	$12,700,000	$15,600,000	$12,320,000	$ 7,400,000
Land and damage	1,165,000	1,900,000	2,550,000	2,210,000	3,360,000
Relocations and clearing	2,300,000	6,190,000	10,360,000	2,615,000	6,190,000
Recreation facilities (b)	875,000	1,740,000	3,050,000	4,090,000	5,080,000
Total	14,990,000	22,530,000	31,560,000	21,235,000	22,030,000
Interest during construction	970,000	1,460,000	2,050,000	1,380,000	1,432,000
Total investment	15,960,000	23,990,000	33,610,000	22,615,000	23,462,000
Average Annual Charges					
Interest, 3-1/4%	519,000	780,000	1,090,000	735,000	763,000
Amortization in 100 years	22,000	33,000	47,000	31,000	32,000
Operation and maintenance	121,000	154,000	215,000	272,000	301,000
Major replacement	26,000	27,000	33,000	44,000	51,000
Land productivity loss	7,000	8,000	29,000	21,000	27,000
Total	695,000	1,002,000	1,414,000	1,103,000	1,174,000
Average Annual Benefits					
User benefits					
Flood control	50,000	80,000	130,000	130,000	45,000
Water quality control	142,000	230,000	510,000	498,000	425,000
Recreation	164,000	252,000	543,000	1,015,000	1,130,000
Total	356,000	562,000	1,183,000	1,643,000	1,600,000
Expansion benefits, national					
Development	8,000	10,000	20,000	57,000	35,000
Redevelopment	148,000	217,000	296,000	235,000	254,000
Total	156,000	227,000	316,000	292,000	289,000
Expansion benefits, national plus regional					
Development	60,000	100,000	200,000	404,000	520,000
Redevelopment	368,000	517,000	759,000	684,000	745,000
Total	428,000	617,000	959,000	1,088,000	1,265,000
Total benefits					
User	356,000	562,000	1,183,000	1,643,000	1,600,000
National	512,000	789,000	1,499,000	1,935,000	1,889,000
National plus regional	784,000	1,179,000	2,142,000	2,731,000	2,865,000
Net Benefits					
User	-339,000	-440,000	-231,000	540,000	426,000
National	-183,000	-213,000	85,000	832,000	715,000
National plus regional	89,000	177,000	728,000	1,628,000	1,691,000

(a) Limited to 750 acre feet per square mile of drainage area or that provided by 30-foot drawdown, whichever is least.

(b) Initial facilities plus present worth of future facilities.

each instance, it was assumed that construction of Gathright was complete. The evaluation of annual charges and benefits differs from that used in subsequent project formulation studies, as follows:

a. Land productivity loss has been based on cost of land only rather than cost of land and improvements.

b. Other types of income which would accrue from the reservoir area in the absence of the projects have not been deducted from project expansion benefits.

c. The national redevelopment benefits indicate amounts which should be transferred to the national development benefit category.

These differences have not been eliminated because they are too minor to influence the site selection decision.

This table clearly indicates that the average annual net benefits for projects at the Stackmine, Hays, and Griffith sites are relatively small. Accordingly, these projects were eliminated from further consideration as the first-priority project.

The net annual user and national benefits of Hipes would be greater than for Stone House but the net national plus regional benefits would be $63,000 less. This difference is about two percent of the total benefits of each project, hardly a significant quantity. Also, there are the following additional differences which are not reflected in the comparison of net benefits:

a. The cost of constructing Hipes project would be less than the cost of constructing the Stone House project and it would control 327 square miles of drainage area as compared to 111 square miles at Stone House. Control of a larger drainage area would provide greater control of flood flows and yield more for the maintenance of low flows.

b. At Hipes the subsurface exploration has been fairly extensive. This damsite is located in an area of stable, uniform, tight shales having great thickness and no tendency to solution. The Stone House damsite is situated on limestone of a potentially soluable nature, as evidenced by the numerous sink holes and caverns nearby. There has been no subsurface exploration to check the solubility, the jointing, clay-filled seams or the geological attitude of the rocks. The reservoir itself would be underlain by soluble limestones and no investigations have been made to check present or potential future leakage.

c. The amount of land suitable for agricultural use in Hipes Reservoir area is less than in Stone House Reservoir area. This situation is reflected in the estimate of cost.

d. The presence of extensive National Forest owned lands immediately adjacent to the Hipes Reservoir would give it a great potential for future development, such as the development of a large park, either state or national , which would compliment the existing National forest lands. There are no extensive wild areas adjacent to the Stone House Reservoir site.

These analyses clearly indicated that a multiple purpose reservoir at the Hipes site was the most feasible plan to meet the needs for water control in the upper James River Basin in Water Sub-region C. Subsequent studies were therefore limited to the determination of the optimum development of the proposed Hipes Reservoir project.

To meet needs in headwater areas of the sub-region, upstream watersheds were investigated. Watershed projects studied are shown on Figure 6-8, and summarized in the following table. More details on these projects are contained in Appendix A of this report.

TABLE 6-11
UPSTREAM WATERSHED PROJECTS STUDIED

Watershed	Counties	Watershed area sq. mi.	Projects Investigated — No. of Projects: Flood control	Flood control, water supply	Flood control, recreation	Total	Drainage area controlled, sq. mi.
Cowpasture	Alleghany, Bath, Highland, Pendleton, W.Va. (a)	388	4	2	0	6	184
Catawba	Botetourt, Craig, Roanoke (a)	115	2	2	2	6	60
Dunlap	Alleghany, Monroe, W.Va. (a)	122	5	1	1	7	45
Jackson 2	Highland, Bath	157	2	2	0	4	63
Jackson 5	Alleghany, Botetourt, Bath	115	0	2	1	3	37
Ogle	Alleghany	46	4	1	1	6	44
Back Creek	Highland, Bath	141	0	1	1	2	76
Calfpasture	Bath, Rockbridge, Augusta	186	4	3	2	9	65
Potts	Craig, Alleghany, Monroe, W.Va. (a)	173	0	1	2	3	91
Totals		1,443	21	15	10	46	665

(a) Not in Sub-region C.

EXPEC

PLANN

UPSTREAM WATERSH
IDENTIFICAT

EXPECTED TO EXIST BY

2 JOHNS CREEK

ALTERNATIVES AVAILABL

7 COWPASTURE RI
8 CATAWBA CREEK
20 DUNLAP CREEK
31 JACKSON RIVER

34 JACKSON RIVER
47 OGLE CREEK
10 BACK CREEK
13 CALFPASTURE
49 POTTS CREEK

LEGEND

RIVER BASIN BOUNDARY

WATER SUB-REGION C BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR

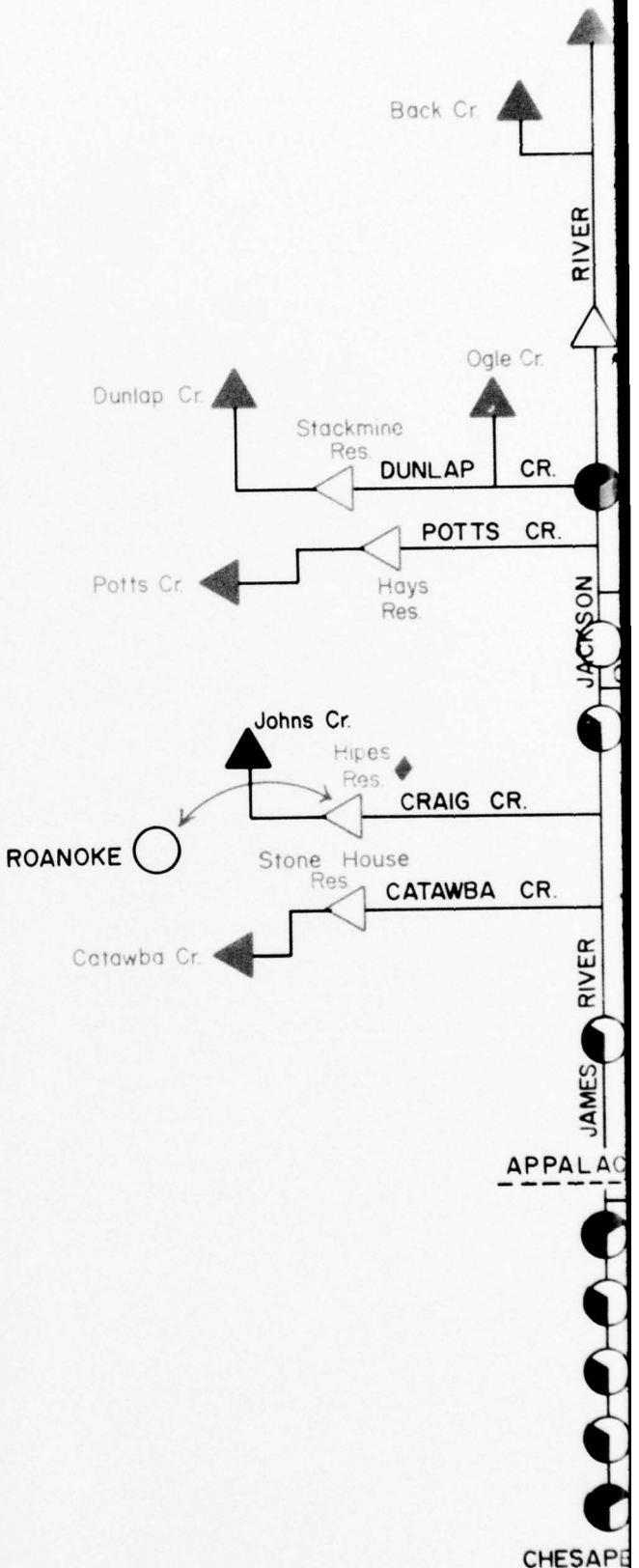
UPSTREAM WATERSHED PROJECT

PLANNING ALTERNATIVES

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

RECREATION DEVELOPMENT



UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

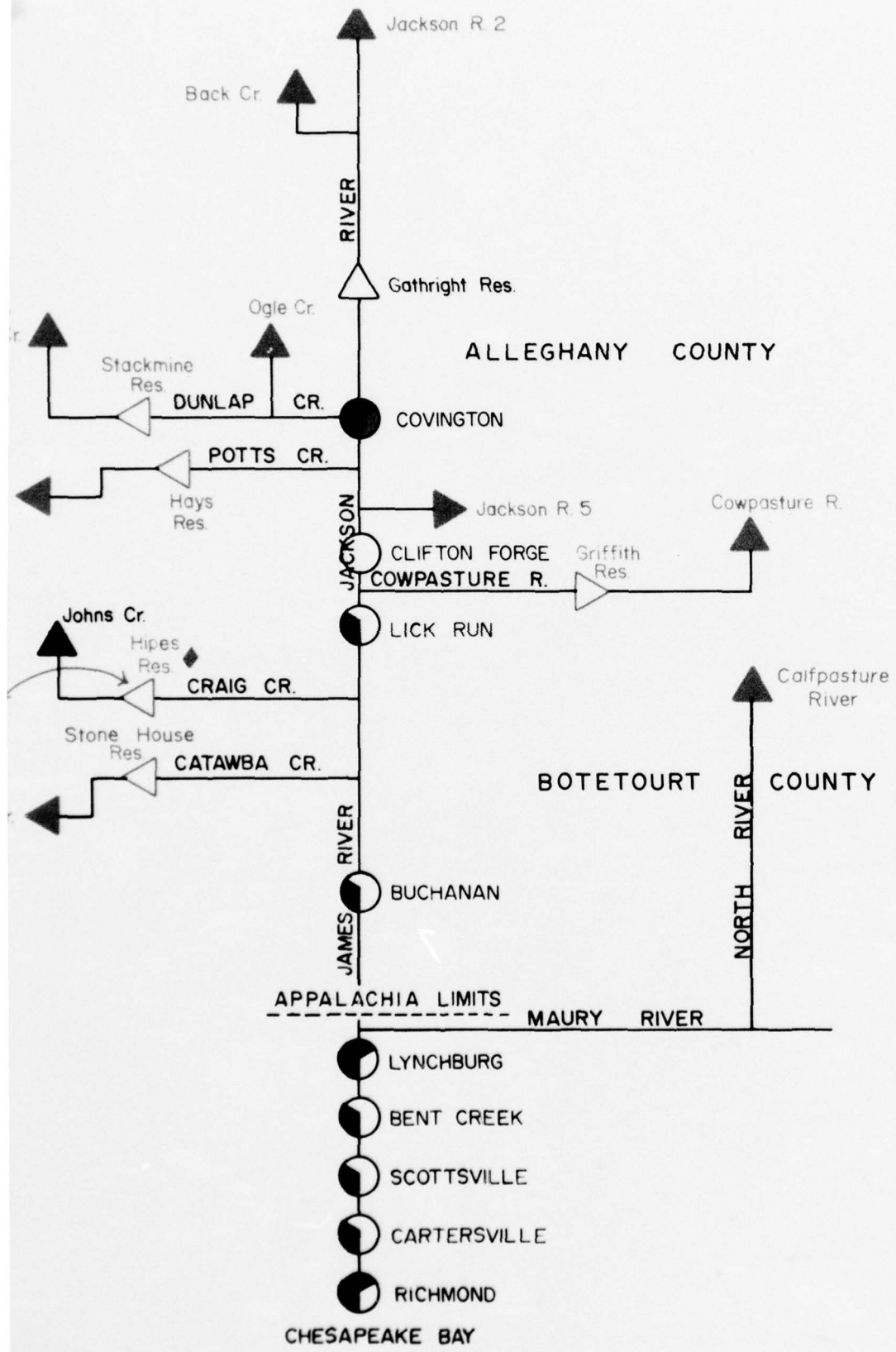
2 JOHNS CREEK

ALTERNATIVES AVAILABLE FOR PLANNING

7 COWPASTURE RIVER
8 CATAWBA CREEK
20 DUNLAP CREEK
31 JACKSON RIVER 2

34 JACKSON RIVER 5
47 OGLE CREEK
10 BACK CREEK
13 CALFPASTURE RIVER
49 POTTS CREEK

2



LEGEN

NEEDS

WATER QUALITY

WATER SUPPLY

FLOOD CONTROL

ALTERNAT

EXPECTED TO EXIST

MAJOR RESERVOI
NON-FEDERAL

UPSTREAM WATER

PLANNING ALTERNATI

MAJOR RESERVOI

UPSTREAM WATE

TRANS-BASIN DIVE

RECREATION DEVEL

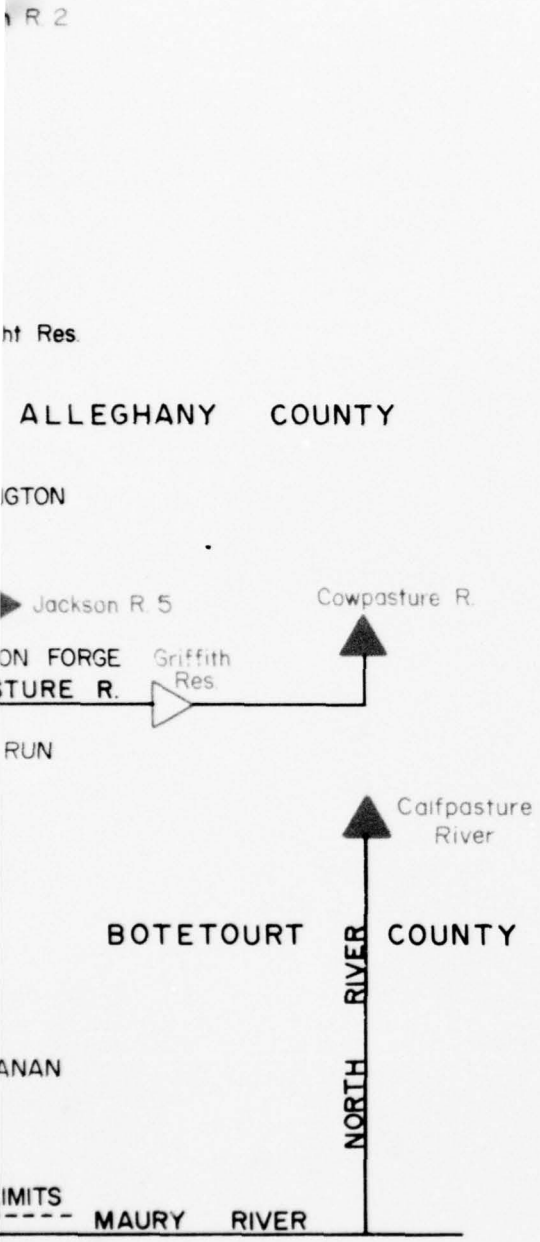
OTHER

COUNTY NAME GROWTH CENTER

UPPER JA
RIVER B

VIRGIN

SCHEMATIC OF
AN
ALTERNATIV



LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- UPSTREAM WATERSHED PROJECT

PLANNING ALTERNATIVES:

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- TRANS-BASIN DIVERSION
- RECREATION DEVELOPMENT

OTHER

COUNTY NAME GROWTH CENTER

UPPER JAMES
RIVER BASIN

VIRGINIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

FIGURE 6-8

Land Treatment Measures

Water resources are affected by the use, treatment, and management of all lands. Conservation treatment on cropland, pasture, and forest and woodland, with practices to limit the soil loss and utilize the moisture will need to be accomplished. According to the U.S. Department of Agriculture, development of the physical potential to meet the land treatment needs by 1980 can be accomplished, in part, by acceleration of the present rate of planning and application of land treatment measures. Appendix A contains more detailed information on the subject than is summarized in the following paragraphs.

The present and accelerated planning and application of conservation measures for a ten-year period are shown in the following tabulation.

	Units	Present	Acceleration	Total
Cropland	Ac.	5,000	3,500	8,500
Grassland				
Improved	Ac.	48,800	15,000	63,800
Established	Ac.	6,000	6,000	12,000
Critical Area Treatment				
Roadbank Stabilization	Ac.		800	800
Surface Mined Areas	Ac.	200	200	400
Recreation and Wildlife				
Farm Ponds	No.	22	14	36
Fish Pond Management	No.	150	90	240
Recreation Access Roads	L.C.	31,500	16,000	47,500
Wildlife Habitat Development	Ac.	400	200	600
Wildlife Habitat Preservation	Ac.	100	100	200
Conservation Plans	No.	320	300	620
Soil Survey	Ac.	113,000	1,185,000	1,298,800

The accelerated State and private forestland treatment measures recommended include those that can be installed by State and private landowners by 1980. These land treatment measures include approximately 3,000 acres of tree planting; 1,000 acres of erosion control; 9,500 acres of hydrologic stand improvement; and 9,500 acres of woodland grazing control.

Planned accelerated land treatment measures for the George Washington and Jefferson National Forests are:

Measure	Units	Acceleration
Timber Management	Ac.	294,200
Soil & Water Management		
Gully stabilization	Ac.	710
Streambank stabilization	Ac.	250
Stream channel cleaning	Ac.	950
Rehab. abandoned roads & trails	Ac.	510
Mined area stabilization	Ac.	10
Sheet erosion control	Ac.	1,680
Soil surveys	Ac.	494,100
Watershed analysis	Ac.	300,000
Fish & Wildlife Management	Ac.	517,800
Land Acquisition	Ac.	130,000

Development of Recreation Facilities

Sub-region C offers a wealth of potential to attract non-resident visitors. Its scenic resources are second to none in Appalachia. Existing and proposed interstate highway access (See Figure 5-4, page II-5-13) to the sub-region should foster the tourist industry from near and distant metropolitan areas. The renowned Blue Ridge Parkway presently succeeds in attracting millions of visitors to the Roanoke area. The interstate highways under construction, and the proposed Allegheny Parkway west of Covington will complete the major avenues of approach to Sub-region C. It is anticipated that the growth centers would function as major service complexes for visitors to the sub-region.

The focal points of an outdoor recreation plan for Sub-region C are envisioned as the development of (a) destination complexes where general and fish and wildlife recreation opportunities abound, and (b) community recreation areas and service complexes at the growth centers. Destination areas would have attractions suitable to hold visitors overnight and preferably longer. Usually such areas are recreation complexes where the visitor has opportunity to participate in a variety of activities. In addition, the complex forms a focal point from which the visitor has access to nearby attractions. The Gathright and Hipes projects, later described in this chapter, are examples of potential destination areas; Douthat State Park is an existing one within Sub-region C. Community recreation areas satisfy public needs for outings within a relatively short distance from the participant's home. These can be provided in part by upstream watershed reservoir projects of the U.S. Department of Agriculture. Communities without active park and recreation programs overlook a significant aspect of land-use planning. Leaders of industry are often hesitant about locating new plants or facilities in communities that do not satisfy the recreation needs of employees and their families.

Development of recreation opportunities in the sub-region faces one significant problem. Much of the topography, while scenically attractive, is steep and unsuited for either construction of mass-use areas, or access roads to them. For example, at Douthat State Park increasing visitor use prescribes the need for expansion of existing facilities, yet it is difficult to foresee as a result of steep terrain.

The water development plan for the sub-region could provide specific entities which can fulfill most of the needs for the foreseeable future. Implementation of the plan would satisfy much of the immediate needs for water-based general and fish and wildlife recreation opportunity. However, two factors point toward the necessity of considering an expanded recreation plan: (1) increasing demand, especially beyond 1980, as shown previously in Section II, and (2) the need to provide for a variety of opportunities for those who elect to stay within as well as those who visit the sub-region. A comprehensive outdoor recreation and fish and wildlife plan would seek to satisfy these requirements as much as possible.

The U.S. Forest Service in its proposal for an accelerated ten-year program studied the following alternative developments:

1. Hidden Valley - George Washington National Forest:

   This major complex, with beautiful Jackson River flowing through it, should be developed for low-to-middle income bracket families. As envisioned, the 700 acres of suitable land can be developed for basically all types of outdoor recreation activities, possibly even for a winter sports area.

   Estimated Cost - $6.5 million

2. New Castle Complex - Jefferson National Forest:

   A major development including a 25- to 50-acre lake is needed in this area.

   Estimated Cost - $1.5 million

3. Buchanan Complex - Jefferson National Forest:

   This area, a mile or two from Interstate 81, on the James River, could provide facilities for 2,000 persons at one time.

   Estimated Cost - $1.5 million

4. Hipes Reservoir - Corps of Engineers - Jefferson National Forest:

   In the event the proposed Hipes Reservoir becomes a reality under the Appalachian Program, recreation development in this project would be substituted for the New Castle Complex and Buchanan Complex proposals.

   Estimated Cost - $3. million

Since the Hipes Reservoir is proposed as an element of the water resource plan for Sub-region C, alternatives (1) and (4) were selected.

Flood Plain Management

The major elements of the water resource plan were developed with a view towards proper use and management of the flood plains. Flood plain studies should be programmed consistent with priorities set for development of the structural elements. Four areas, as shown in Figure 6-9, (Page II-6-533) have been identified where studies should be made in the near future.

Future Studies

Since the Roanoke area lies beyond the boundaries of Appalachia, no specific effort has been made to develop a solution to the problems in that area; however, some probable solutions are presented in the following paragraphs which would affect the associated Appalachian area in Botetourt County.

To resolve the water supply problem, the municipalities of the Roanoke area have elected to develop small water supply reservoirs near the needed points. This is considered a reasonable approach to meeting the needs in the foreseeable future and will permit ample time to develop a suitable regional plan for the development of the water resources of the upper Roanoke River Basin.

A comprehensive study of the upper Roanoke River Basin is needed to insure that optimum use is made of the available water resources of that region. A development plan should be prepared that assures best multiple use of the natural flows of the Roanoke River and its tributaries and meets the needs for the continued economic growth in this region. In this connection, it should be recognized that the flow in the James River Basin is needed to assure continued economic development of this watershed.

The development of a proper sewerage collection system and adequate treatment facilities, along with possible augmentation of streamflow during low-flow periods, is considered a reasonable solution to present or future sewerage problems.

10. ADJUSTMENT OF PLAN

Practically all of Sub-region C is located in the headwater tributaries of the James River Watershed. Consequently, the water resource development plan could not be adjusted to provide appreciable benefits to other sub-regions in Appalachia. However, any plan considered for the development of the water resources in Sub-region C will provide benefits of considerable magnitude in the lower James River downstream from Appalachia. As will be indicated later, considerable flood control and low

water regulation benefits downstream from Appalachia and creditable to the proposed comprehensive plan have a material influence in justifying the Hipes Project from the national viewpoint. Furthermore, the water-based recreation features of the plan will also provide recreational opportunities to people in the adjoining sub-regions in Appalachia as well as to those living in the metropolitan areas along the Atlantic coast.

11. RESULTING PLAN

The plan selected for development of the water resources in Sub-region C is shown on Figure 6-9 (Page II-6-53) and would include:

a. Gathright Reservoir as presently being constructed.

b. Completion of construction of Johns Creek upstream watershed project.

c. Hipes Reservoir to be located on Craig Creek, a tributary of the James.

d. Continued planning on 9 upstream watershed improvement projects which would be feasible and compatible with over-all planning of the James River Basin.

e. Acceleration of land treatment measures of agricultural areas over a ten-year period with priority to the drainage areas above the Gathright and Hipes Reservoirs.

f. Accelerated ten-year program of land treatment measures on National, state and private forest lands with same priority as in (e).

g. Acceleration of 2 recreational developments in the George Washington and Jefferson National Forests.

h. Flood plain management activities at 7 locations to be coordinated in the plan to obtain proper future development of flood plains. Studies at 4 of these locations are currently in progress and three studies are needed.

i. Studies to formulate a plan for the development of the water resources of the Roanoke River above Roanoke, including water supply for that portion of the metropolitan area in Botetourt County.

12. EFFECTIVENESS OF THE PLAN

The comprehensive water resources plan for Sub-region C provides substantial protection to flood plain areas on the Jackson River and the upper James River in Appalachia and significant benefit to the industrial center of Lynchburg and other areas downstream from the limits of Appalachia as far as Scottsville, Virginia. Gathright and Hipes Reservoirs

would control about 20 percent of the 3,305 square miles of the James River Watershed above Lynchburg. These projects would provide protection to residences, commercial and industrial establishments and utilities in urban areas such as Covington, Clifton Forge, Eagle Rock, Buchanan, Glasgow, and Lynchburg. Damages to transportation and communication facilities and interruption of services and use would be reduced. Agricultural areas along the river can be made more productive and profitable and other flood plain areas can be put to better use. In addition to the flood damage reduction afforded by Gathright and Hipes Projects, further prevention of damages can be accomplished by flood plain management activities.

Gathright will reduce the average annual damages on the James and Jackson Rivers above Scottsville, Virginia from $729,000 to 359,000 dollars. Damages in Sub-region C are reduced from $310,000 to 57,000 dollars. Addition of the Hipes Project would reduce the average annual damages further, from $359,000 to $229,000, providing a flood control benefit of 130,000 dollars. Damages in the sub-region would be reduced from $57,000 to 27,000 dollars.

Gathright and Hipes Reservoirs would beneficially affect the quality of the water throughout 45 miles of the Jackson, plus the entire 340-mile length of the James River. The benefits would be widespread, affecting some 1/2 million persons, with greater benefits occurring near population or industrial centers. The primary uses to be preserved are water supply, fish and aquatic life of the stream (biological characteristics), and recreation. Water of a quality sufficient to protect fish and aquatic life in the stream also provides water satisfactory for other beneficial uses. For this reason, the biological characteristics of the streams are of primary consideration. The parameter most affecting a stream's biological characteristics is the dissolved oxygen (D.O.).

Hipes Reservoir, together with Gathright, would increase stream flow to an extent that would dilute the waste load in the Jackson River along the Covington-Clifton Forge area and in the James River at Lynchburg and vicinity, as well as in the estuary of the James River at and below Richmond, and thereby increase to a significant degree the natural ability of these streams to assimilate the residual wastes. In meeting the dissolved oxygen requirements set by State and Federal agencies of five milligrams per liter by low flow augmentation, Gathright and Hipes together can be expected to eliminate problems of low dissolved oxygen concentrations throughout the length of the Jackson and James River to Richmond beyond year 2020 and below Richmond to year 1993. However, to meet the stream quality objectives along the hundreds of miles of streams, effective waste treatment must also be accomplished. Effective treatment is considered to be removal of 85 percent of the BOD of the municipal and industrial waste load.

The stream flow to be maintained on the Jackson and James Rivers at Covington, Lynchburg, and Richmond to maintain the dissolved oxygen

at objective level, after adequate treatment of waste, is stated in Section II of this Chapter. The average annual benefit of storage in Gathright Reservoir for the purpose of water quality control is estimated at $584,000 annually. The incremental benefit attributable to Hipes is estimated at $490,000 annually.

Recreational areas and facilities included in the sub-regional plan of water resource development and those operating and expected to be in operation will assist in meeting the recreation needs of the sub-region. A major portion of the recreation opportunities anticipated in the plan would be associated with the large water-storage developments and public access areas at Gathright and Hipes Reservoirs.

Gathright Reservoir will have as its chief scenic attraction a large expanse of inland water with rugged terrain and rocky gorges, coupled with an irregular wooded shoreline. The reservoir will offer an ideal setting for the recreation activities appealing to ever-increasing numbers of American families - camping, picnicking, boating, swimming, fishing, hunting, hiking, riding, water-skiing, nature study, and conservation education. The climate, topography, vegetative cover, wildlife, and the proposed large body of water will all be contributing factors that would favor development of opportunity for water-based outdoor recreation.

Because of the extremely rugged topography, available land suitable for recreational development is limited. However, there are some excellent sites available around the periphery of the reservoir for the development of beaches, campgrounds, picnic areas, hiking and horesback trails, nature study areas, and boat launching. These facilities would enhance the already outstanding setting for outdoor recreation.

Annual attendance for Gathright Reservoir is estimated at 300,000 within five years of project completion; and 400,000, the capacity of the project, within 15 years. The net average annual benefits for the selected plan are estimated to be 295,000 dollars.

At maximum conservation pool, Hipes Dam would create a highly attractive reservoir of 4,540 surface areas for water-based recreation. The shoreline would be pleasing and would be enveloped by the undulating faces of scenic mountains. Preliminary studies indicate that sufficient land areas can be made available adjacent to the reservoir for parking, picnicking, camping, fishing, boating, water skiing, and sight-seeing.

A good regional highway network including Interstates 64 and 81 would provide access in close proximity of the project. Local access is available by several all-weather roads through the scenic, hilly terrain surrounding the reservoir. Improvement of Virginia Secondary Highways 606 and 615 from U.S. Highway 220 would assist to facilitate public access to Hipes Reservoir.

It is estimated that an ultimate annual attendance of about 1,000,000 would result from the recreation development at this reservoir. The net average annual benefits are estimated to be 1,012,000 dollars.

At both Gathright and Hipes, a cold water trout fishery is planned in Jackson River and Craig Creek downstream from the projects. An additional enhancement feature of the Hipes Project would be a trout rearing station below the dam.

In addition to meeting demands for recreational activities, the plan would augment the highly important tourist industry. Thus, the area would become much more attractive to industries and potential residents from other parts of the country. The recreation proposals, when implemented, would also tend to perpetuate the land and water resources in a condition suitable for continued use and appreciation.

Within the Alleghany County Growth Center, the Gathright Project can provide the necessary additional water for municipal and industrial needs. The Botetourt County Growth Center contains the major water supply reservoir for the Roanoke Metropolitan Center and is grouped with that area in connection with joint regional studies to meet water supply needs in the Roanoke Area. A comprehensive investigation of the water resources potentialities of the Roanoke River above Roanoke is required and this would include the provision of water supply for the Botetourt County Growth Center adjacent to the Roanoke Metropolitan Area.

Other communities within Sub-region C are small and their present water needs are obtained from existing surface streams and/or ground water in the vicinity. According to the U.S. Geological Survey, the cost of producing a substantial amount of ground water at a well head could be as little as $0.05 per 1,000 gallons in the northern part of the sub-region, to between $0.05 and $0.25 in the southern part. A central source of water is not practical for these widely scattered communities, so that present sources will generally continue as long as these sources are reasonably adequate. However, the program of upstream reservoir development proposed by the Department of Agriculture could provide storage for water supply to many of the small communities in the headwater reaches. In the lower reaches of Appalachia, the minimum flow of more than 100 million gallons a day in the James River should satisfy the requirements of the larger potential industrial water users.

Improvement of streams in the sub-region specifically for navigation was not considered feasible. However, the large reservoirs created by Gathright and Hipes Dams will provide navigation for the recreational craft expected to utilize these projects.

Hydro power facilities are not incorporated in the water resources development plan. Installation of conventional hydro power facilities in either Gathright or Hipes is not economically feasible because power can be produced at less cost at a comparably financed steam-electric generating station. Construction of pumped storage facilities integral with these

projects is also not justified. Undoubtedly, opportunities for adjoining type pumped storage facilities can be found near these projects or in any of the high mountain peaks near streams. These are not precluded from development by the proposed plan in this report, and can be constructed if and when found to be necessary and/or feasible.

There are practically no instances of the practice of irrigation in Sub-region C at present. Rainfall is usually adequate during the crop-growing season and the cost of equipment is sufficiently great to deter irrigation to any extent in the future. The Soil Conservation Service considers the future irrigation requirement to be extremely small. Reallocation of storage could provide water for irrigation if the need arises.

At present, there are no known serious vector problems in the sub-region. Health aspects of water resource development require the prevention and control of vectors which carry human disease organisms or which affect man's comfort, mental equanimity, and economic welfare. Vector prevention and control measures, to be incorporated in the design or planning stages of the reservoir projects, will provide adequate public health safeguards against vector problems that may arise. These include mosquitoes from proposed impoundments and terrestrial arthropods and rodents from the related land resource. The U.S. Public Health Service has prepared information on health guidelines to assist agencies in the prevention and control of disease vectors. Further details are included in Appendix D.

Installation of the accelerated land treatment programs proposed by the U.S. Department of Agriculture on privately owned lands would be effective in meeting the most urgent needs expected by 1980. These programs would result in estimated annual benefits of $183,000 in addition to expansion benefits of $80,000 or a total of $263,000 to the Sub-region's economy. Another major program of the Department is the acceleration of planning and activities required for development of the National Forests involving such a large portion of the sub-region. Further, completion of the Department's upstream watershed projects, now being actively prosecuted in connection with the James River Basin Survey, will result in a reservoir and channel clearing program for Sub-region C that would provide a substantial reduction in flood damages, storage for municipal and industrial water supply, and fish and wildlife benefits. These headwater reservoirs would also have a beneficial effect in reducing sediment damages.

With the development of the plan described in this section of the report, the remaining water problems in Sub-region C should be minimal. There will remain flood problems in areas for which flood protection is not practical or feasible. Flood plain management activities should suggest methods by which the flood damage to developments or structures already on the flood plain may be alleviated by flood proofing or adjustment of activities in the area. A clear indication of the flood hazard, accompanied by flood plain zoning regulations and proper building codes, should deter further improper or unwise use of the flood plain.

SECTION V - PLAN ELEMENTS DESCRIPTION

13. THE PLAN

A description of the elements of the plan are contained in the following paragraphs. See Figure 6-9 (Page II-6-53) for geographic locations where they are appropriate.

Gathright

Gathright Reservoir is now under construction by the Norfolk District, Corps of Engineers. It is located 43.4 miles above the mouth of Jackson River and 19 miles upstream from Covington. The dam and a portion of the reservoir will be in Alleghany County, with most of the reservoir being in Bath County. The drainage basin above the dam is 344 square miles.

Gathright Dam consists of a 1,172-foot long, rolled-rock-fill dam with an impervious core with the top at elevation 1684.5; outlet works consisting of a concrete intake structure located in the right bank 500 feet upstream from the axis of the dam, a 1,075-foot long outlet tunnel through the right abutment and a stilling basin; and a 125-foot long, fixed-crest emergency spillway excavated in a low saddle in the divide at Fortney Branch about 2.5 miles south of the dam. Discharges through the outlet tunnel will be controlled by slide gates located in the intake structure. About 60,700 acre-feet of storage below the maximum conservation pool elevation 1582 will be provided for water quality control. The reservoir area at elevation 1582 will be 2,530 acres. A total of 79,900 acre-feet of storage between elevation 1582 and the top of flood control pool at elevation 1610 will be utilized to control floods to non-damaging stages. An additional 222,400 acre-feet of storage between elevation 1610 and the spillway crest (elevation 1668.5) will be utilized to store extreme floods to avoid expensive spillway construction.

Hipes

The Hipes multiple-purpose reservoir project is located on Craig Creek in Botetourt County, Virginia, 14.8 miles above the mouth and about 12 air miles southeast of Covington. The dam, as now planned, would be constructed of impervious material and have a length of 2,400 feet from the right abutment to the spillway. Maximum height of the dam will be 172 feet with the top elevation at 1187. The 30-foot wide crest will accommodate an 18-foot roadway. A short dike 120 feet long at the top, having the same characteristics as the dam, will be built in the saddle 1,900 feet northwest of the spillway. The spillway will be located in a draw through the left abutment ridge. Water will be discharged back to the river 2,300 feet downstream from the toe of the dam. The spillway crest will be at elevation 1143 and will have three 50-foot wide by 34-foot high tainter gates. The outlet works will consist of an intake tower, a conduit, and a stilling basin, situated on the left bank.

PRECEDING PAGE BLANK-NOT FILMED

The reservoir, when filled to the top of the conservation pool, elevation 1160, would extend for 17-1/2 miles up Craig Creek and into Craig County. The area of the surface would be 4,540 acres and the depth of water at the dam would be approximately 145 feet. A trout rearing station would be constructed immediately downstream from the dam. (For details see Part III, Chapter 4). The trout produced would be stocked in streams in Appalachia and support 112,500 fishermen days of recreation. A visitor center would be provided as an added tourist attraction. The opportunity to construct this station is created by the cold water which will be available in Hipes Reservoir. Also, the project will be designed and operated so that conditions suitable for trout will be created in Craig Creek downstream from Hipes Dam. Access areas will be acquired and developed and such easement as may be necessary for right of use of the stream bed to the ordinary high water line will be acquired along this reach of Craig Creek.

Upstream Watershed Projects

Small upstream watershed projects in the upper James River Basin have been investigated by the U.S. Department of Agriculture in connection with the Congressionally-authorized James River Basin Study. As a result, it has been concluded that 9 upstream watersheds should be included for accelerated project sutides. It is presently intended that these watersheds, together with others in the James Basin not in the Sub-region, will be rcommended for authorization for advanced planning in the James River Basin Study, now scheduled for completion in 1970.

Construction of the 9 upstream watershed projects found feasible in preliminary studies could provide varying degrees of protection to 20,646 acres of damaged flood plains within these watersheds. These damaged flood plains contain crop and pasture lands, urban and industrial developments, roads and bridges, and other transportation facilities. In addition, to the flood prevention storage in these structures, some could be multiple-purpose structures providing additional water storage.

Water storage for recreational use could be contained in the above structures. These structures would provide 7,632 acre-feet of storage. In addition to the water storage, these developments would include basic facilities, such as parking lots, roads and trails, boat docks and ramps, picnic shelters, and other similar or related permanent type facilities needed for public health and safety.

Municipal and industrial water supply needs could be provided for 26,170 acre-feet serving a population of approximately 49,830 people. The developments would provide only the physical storage for water supplies. In addition to the water storage, many of the municipalities would need to develop a water system to convey and distribute the needed water.

Storage of water for quality management can also be provided in these structures. This could be utilized to further improve the quality

of the water in the many streams. Other provisions, developments, and improvements would be needed for the treatment of wastes and pollutants before they are discharged or enter the streams.

In addition to the amounts of storage provided for a specified purpose, there are 314,274 acre-feet of potential storage which could be developed in the future. This could be for increasing the assigned development or for new future developments or purposes.

Accelerated Land Treatment Measures

In addition to meeting the most urgent conservation needs of the Sub-region, the U. S. Department of Agriculture recommends acceleration of land treatment and management programs for privately owned and National Forest lands. This acceleration will provide continued production of food and fiber and reduction of floodwater, erosion, and sediment damages. It will also increase outdoor recreational opportunities and improve the water and environmental quality of the sub-region. Priority will be given to critically eroding areas and the drainage areas above the recommended and existing water resource developments of the states, Corps of Engineers and others to improve their efficiency and useful life. The acceleration required is as follows:

a. Adequately treat and protect 3,500 acres of cropland, improve 15,000 acres of pasture and establish 6,000 acres of new pasture planting.

b. Revegetate and stabilize critically eroding areas on 800 acres of roadbank and 200 acres of surface mined areas.

c. Increase recreational and fish and wildlife opportunities by the construction of 14 farm ponds, management of 90 farm ponds for fish production, construction of 3 miles of recreation access roads, development of 200 acres of wildlife habitat, plan for wildlife habitat preservation of 120 acres, and develop 30 acres for picnic areas and 10 acres for camping areas.

d. Develop 300 basic conservation plans and complete detailed soil surveys on 1,186,000 acres.

Acceleration for state and private forest and woodland includes:

a. Plant 3,000 acres in trees.

b. Treat 1,000 acres for erosion control.

c. Treat 9,500 acres for hydrologic stand improvement and protect 9,500 acres from livestock grazing.

d. Develop 90 forest and woodland management plans.

Planned acceleration for National Forests is as follows:

	Acres
Tree Planting	144,000
Timber Stand Improvement	150,000
Soil and Water:	
Gully Stabilization	710
Sheet Erosion Control	1,700
Streambank Stabilization	250
Stream Channel Clearing	1,000
Rehab. Abandoned Roads and Trails	500
Mined Area Stabilization	10
Soil Survey	527,000
Watershed Analysis	300,000
Fish and Wildlife:	
Big Game Range Analysis	494,000
Release of Forage Plants	1,200
Planting Waterfowl Food Plants	40
Seeding and Planting	1,500
Stream and Lake Surveys	21,000

The structural measures include: Construction of (a) 60 acres of waterholes for wildlife and impoundments and potholes for waterfowl, (b) 50 acres of impoundments for recreation, (c) 3 special projects for recreation, (d) 60 miles of road and 20 miles of trails, (e) improvement of 5,600 acres of stream and lake habitat for fish and wildlife, and acquisition of 130,000 acres of land.

National Forest Recreation Development

The acceleration of recreation developments in the George Washington and Jefferson National Forests would include:

a. Development of the Hidden Valley recreation area for both summer and winter outdoor recreation activities.

b. Development of recreational facilities around the proposed Hipes Reservoir.

Flood Plain Management

An important feature of the water resources plan outlined above is the program for flood plain information studies. This will encompass the delineation of the bottomlands subject to various degrees of flood hazard so that officials in urban and rural areas can properly plan for the development of flood plains in their respective areas. Close coordination is being maintained with (a) officials of Covington and Alleghany Counties in the establishment of proper flood plain limits downstream from Gathright, and (b) the Roanoke Valley Regional Commission in insuring proper development on the flood plains of the James River in Botetourt County. Additional studies will be programmed as the water plan progresses. Four specific studies are included in the present plan. The studies should be revised periodically as a "follow-up" to find whether the total program is responsive to changing needs.

NOTE:

1/ INCLUDES EXISTING ELEMENTS (SEE FIGURE 5-13 FOR DISTINCTION)

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980	FOR CONTINUING PLANNING

VIRGINIA

2 JOHNS CREEK

7 COWPASTURE RIVER
8 CATAWBA CREEK
20 DUNLAP CREEK

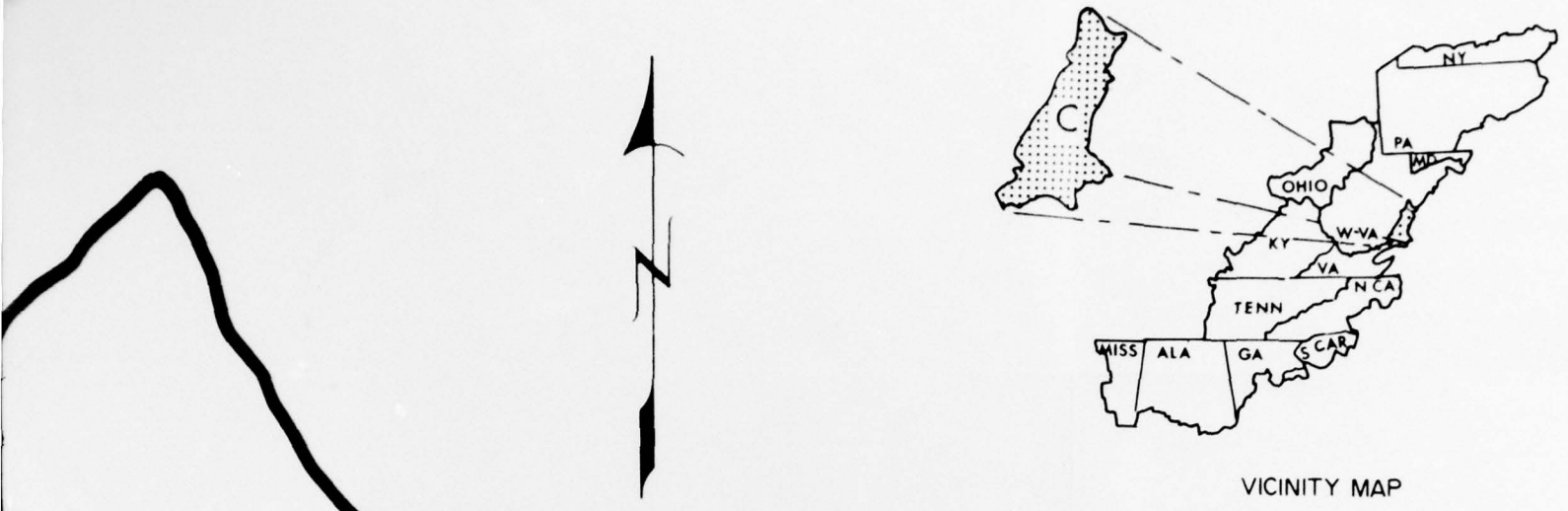
STR

UPSTREAM WAT

EXPECTED

FOR CONTIN

MAJOR RESERV



VICINITY MAP

10 5 0 10 20 30 40 50

SCALE IN MILES

STRUCTURAL

UPSTREAM WATERSHED PROJECTS

(2) EXPECTED TO EXIST BY 1980

(7) FOR CONTINUING PLANNING

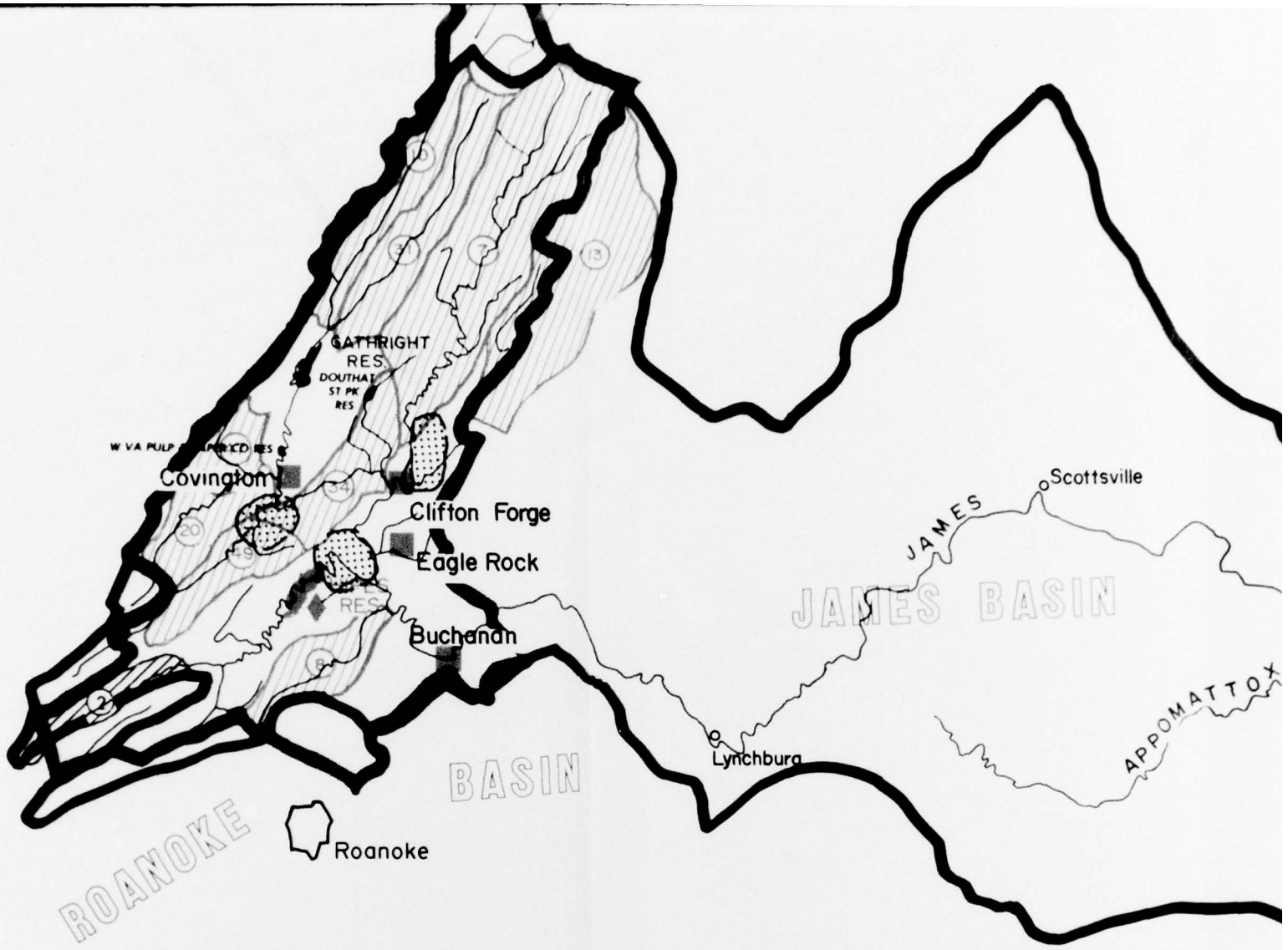
MAJOR RESERVOIRS

NON-STRUCTURAL

FLOOD PLAIN INFORMATION STUDIES

FUTURE STUDIES (ONLY EMPHASIS LIMITS SHOWN)

REPORT FOR
DEVELOPMENT OF WATER RESOURCE
IN



NOTE:

1/ INCLUDES EXISTING ELEMENTS (SEE FIGURE 5-13 FOR DISTINCTION)

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980	FOR CONTINUING PLANNING

VIRGINIA

2 JOHNS CREEK

7 COWPASTURE RIVER
8 CATAWBA CREEK
20 DUNLAP CREEK
31 JACKSON RIVER 2
34 JACKSON RIVER 5
47 OGLE CREEK
10 BACK CREEK
13 CALFPASTURE RIVER
49 POTTS CREEK

STRUCTU

UPSTREAM WATERSHE

EXPECTED TO E

FOR CONTINUING F

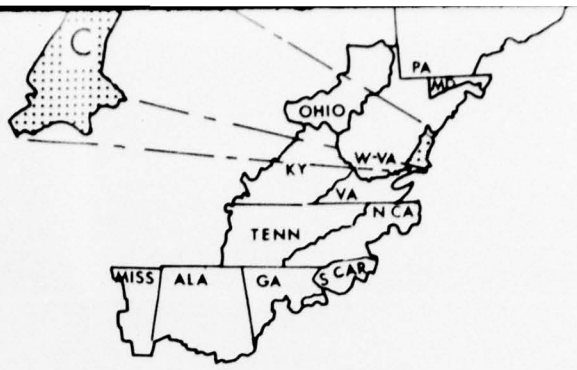
MAJOR RESERVOIRS

EXPECTED TO

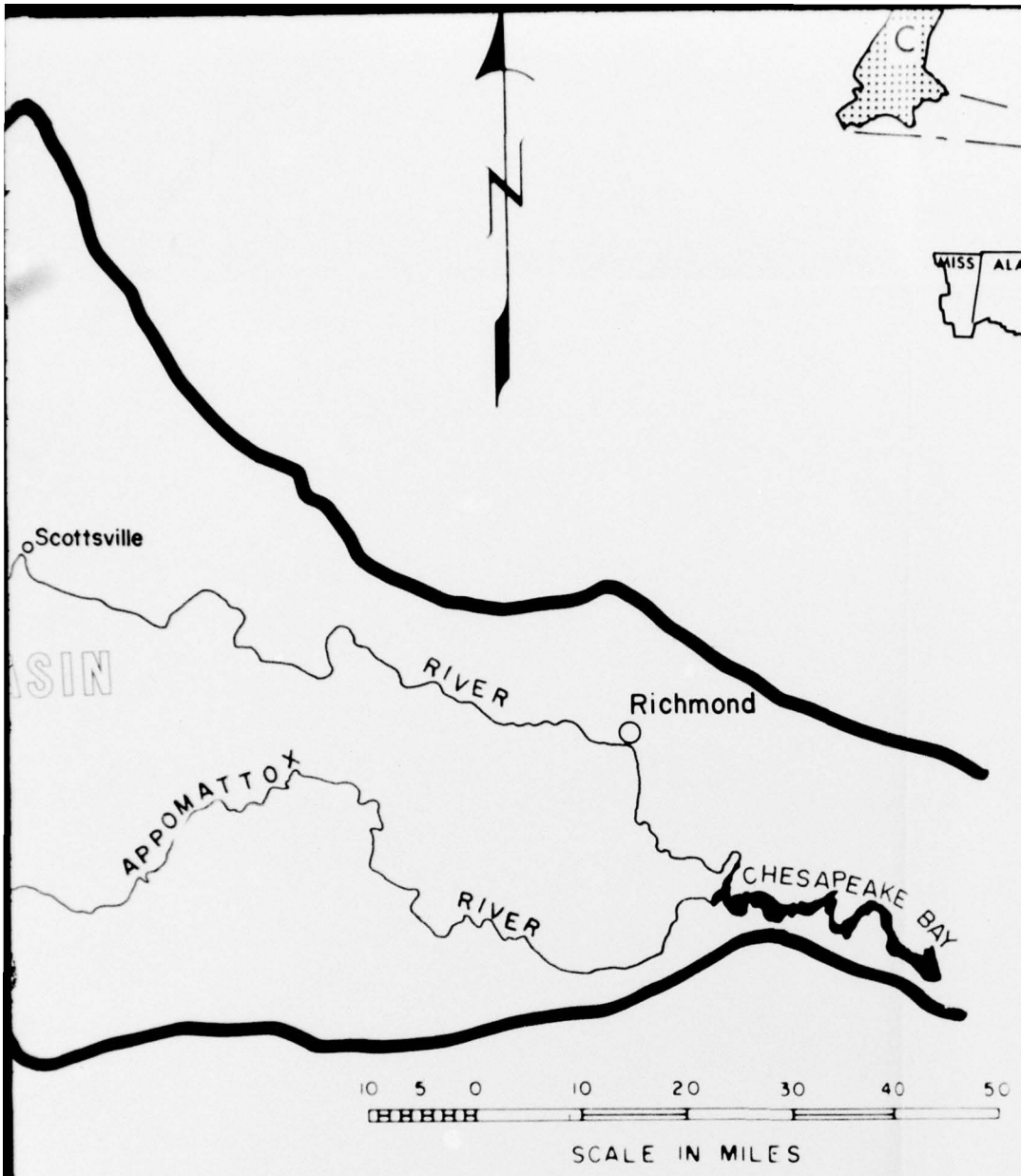
FOR AUTHORI

RECREATION

3



VICINITY MAP



10 5 0 10 20 30 40 50

SCALE IN MILES

STRUCTURAL

REAM WATERSHED PROJECTS

EXPECTED TO EXIST BY 1980

FOR CONTINUING PLANNING

R RESERVOIRS

EXPECTED TO EXIST BY 1980 1/

FOR AUTHORIZATION

RECREATION DEVELOPMENTS

NON-STRUCTURAL

FLOOD PLAIN INFORMATION STUDIES

FUTURE STUDIES (ONLY EMPHASIS LIMITS SHOWN)

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION C

WATER RESOURCES
PLAN OF DEVELOPMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968